The Electrical Industry's Weekly Magazine

February 27, 1956

Electrical World

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Editors Report on AIEE's Winter General Meeting ... Page 16

GENERATION

Generators 300-Mw and up are economically justifiable. Liquid-cooled armature windings forecast 500-Mw units

TRANSMISSION

High lightning outage rate on 330-kv remains unexplained. Cable studies provide clues to future EHV designs

SUBSTATIONS

Two-step reduction in power transformer BIL draws qualified approval. Microwave group examines maintenance

DISTRIBUTION

Controversy continues on higher primary and secondary voltages. Materials offer solution to pole-line corrosion

INDUSTRIAL

Distribution for large office buildings focuses attention of utilities on 265/460 and 277/480-v systems

IN THE INDUSTRY ... Page 62

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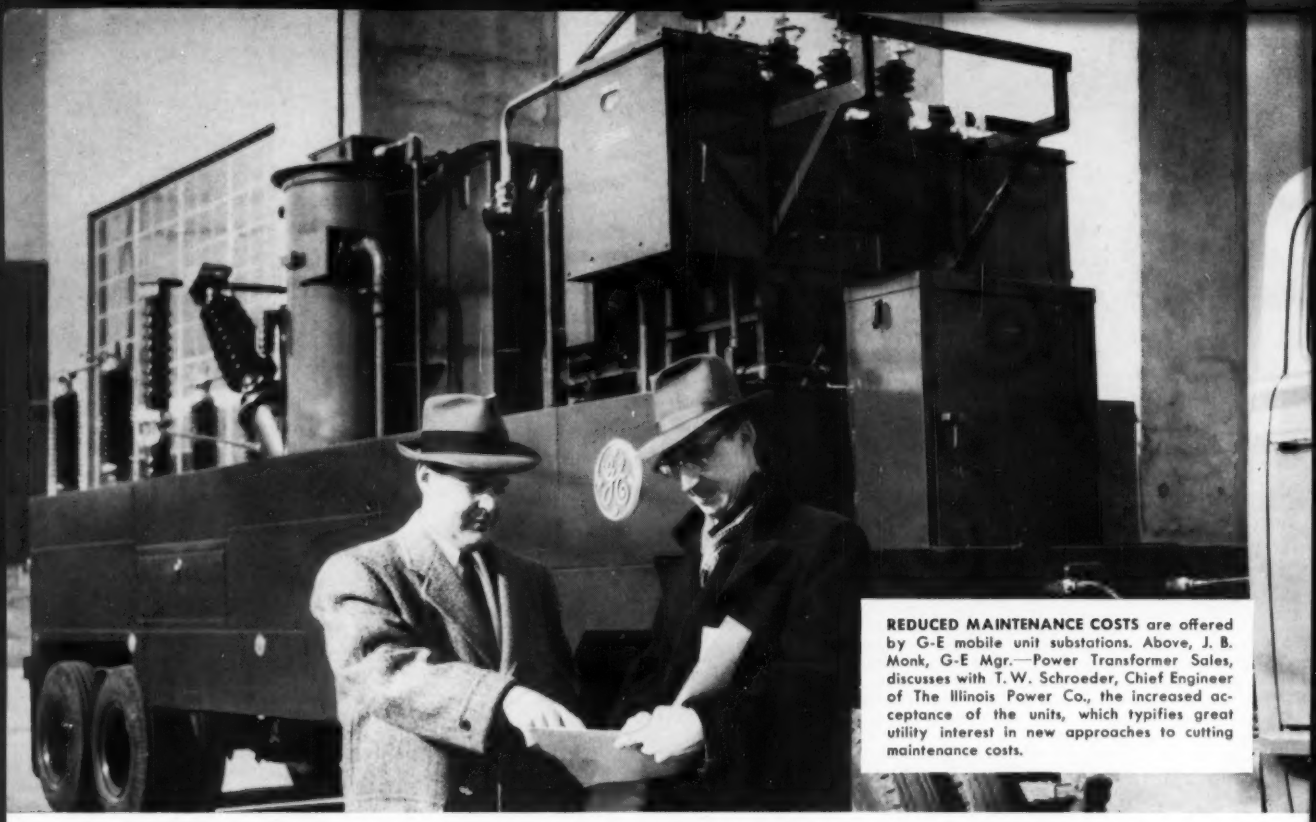
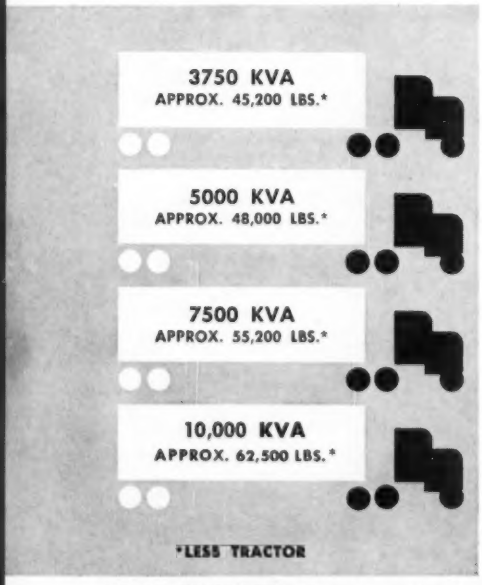


REDUCED MAINTENANCE COSTS are offered by G-E mobile unit substations. Above, J. B. Monk, G-E Mgr.—Power Transformer Sales, discusses with T. W. Schroeder, Chief Engineer of The Illinois Power Co., the increased acceptance of the units, which typifies great utility interest in new approaches to cutting maintenance costs.

Mobile substations typify utility trend to lower-cost maintenance



MOBILE SUBSTATIONS will open new frontiers for cutting expenditures for many companies. G-E units are available in a variety of ratings from 1000 to 10,000 kva. Mobile transformers have been built as large as 25,000 kva.

Recent activity indicates that many utilities have made considerable progress toward reducing maintenance costs through the development of systematic and mechanized approaches to over-all system maintenance. Rapid acceptance, for example, of mobile unit substations for normal equipment servicing, as well as for emergency service, on subtransmission systems has helped reduce routine expenditures on many systems. To further increase these savings by permitting mobile units to replace a greater number of substations, General Electric recently disclosed that it is extending the range of available ratings to 10,000 kva.

PRODUCTIVE MAINTENANCE

Impetus may be added to the growing popularity of the "Productive Maintenance" concept, a program of sensibly scheduled equipment outages, by this extended range of mobile unit substations. Upkeep expense is reduced through the use of mobile substations and mobile transformers as substitutes for regular units in need of service, thus permitting work to be done during regular working hours. Along with recent developments in automation and mechanization in the areas of generation, transmission and distribution, improvements in maintenance point up the utility industry's steady progress in reducing costs.

EXPANSION AND CONTINUITY

As customer demands for more uniform service continue to grow, and as systems continue to expand, utilities will find that often both problems can be eased greatly by sound maintenance planning. For further information on General Electric's mobile substations and how they can help streamline your company's approach to low-cost system maintenance, write for publication GEA-4415, General Electric Company, Schenectady 5, N.Y.

MORE POWER TO AMERICA 301-316

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ELECTRICAL WORLD

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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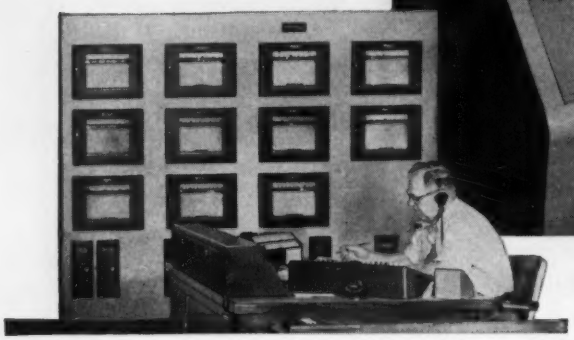
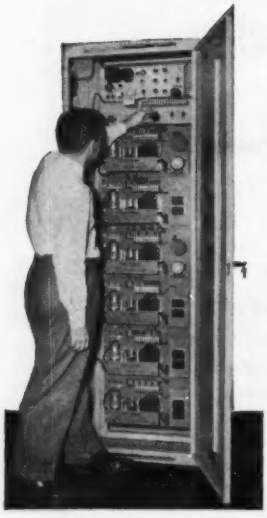
• • •

COMING NEXT WEEK—Industry must modernize to meet the growing demand for all types of products. Today modernization means electrification. And the important man for industry in carrying out its modernization plans is the utility power salesman. A special report will tell how he helps.

CONTROL CONSOLES *are custom engineered by Honeywell for the system or station. Operators can choose flat frequency, flat tie line, or tie line bias control . . . can set up automatically maintained incremental loading schedules.*



HIGH-SPEED TELEMETERING *operates over carrier, wire, or micro-wave channels. Vital information is displayed on easily-read instruments on the dispatcher's panel.*



CONTROL SERVOS *use true feedback techniques for high stability. Speed of response is readily matched to generating system characteristics.*

NEW

electronic control for system load and frequency

HERE'S the fast, accurate, all-electronic way to regulate network interchange . . . system load dispatching . . . generation of individual units in stations. Engineered and built by Honeywell, this new type of control uses highly stable, dependable servo circuits.

It includes continuous, high-speed telemetering using distortion-proof pulse rate transmission. A single channel is usually all that is needed for all control signals for each station. Area and net power totalizing is done rapidly and accurately by electronic circuits.

Control is designed to provide maximum economy of system operation and accurately maintain schedules. "Building block" design simplifies the initial installation . . . makes expansion easy. Ask your local Honeywell sales engineer to discuss your system's requirements . . . he's as near as your phone.

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EDITORIALS

Promote Utility Careers

Electric utilities over the next few years will find there are not enough power majors among engineering graduates to fill utility needs. This is apparent from the preliminary results of a survey now being tabulated by Electrical World. Many junior and senior classes of 20 to 40 students have not a single student majoring in power system design.

The survey now being tabulated strongly indicates that the industry can no longer wait to choose its recruits from among engineering graduates or even engineering students. Efforts must be made to instill an interest in a utility career before the student selects his specialized engineering studies. But by this time it may be too late. An effective campaign to promote utility careers in all positions should begin at the high school level.

Both utilities and schools are gradually coming to recognize this situation and taking steps to meet it. High school faculties are inviting utility management along with other industry management to participate in vocational guidance programs. Through such programs the utilities have an opportunity to present their story and make their bid for guiding the student toward a utility career.

Several methods are already being employed for doing this job. There is some descriptive literature, arrangements are made for plant tours, and utility representatives give talks before high school groups.

But utilities need more tools with which to do the job. For instance, a short movie or slide presentation would dramatize the career possibilities in the industry. Despite considerable search we have not been able to find such a presentation to fill this specific need. If there is no up-to-date presentation along these lines, the industry should consider putting one together. Electrical World would be glad to help in such an effort.

Heat Storm Warning

Will next summer's heat storms affect your system?

Neither the weather prophets nor the almanacs can tell with any certainty today. There is no long range weather forecast to which system planners or operations men can look with confidence. Yet the impact of loads resulting from sustained heat waves that strike an area are becoming as important a factor in system planning and operations as economic trends, population growth, and power use for which forecasts are available.

There is no way of preventing or tempering the heat storm. But utilities must be prepared to withstand their ravaging effects. This means preparing their systems for the drastic demands brought about by the storms. And while this is being done with reasonable dispatch, utilities must prepare for emergencies arising from them.

Midwest and Southwest utilities, hard hit by the 1954 heat storms, have already bared their experiences and outlined their procedures for Electrical World readers (EW, Jan. 10, 1955, p 65). Our editors are now preparing a comprehensive report on utility experiences during last summer's heat storms which struck at underground systems in several metropolitan areas. From the work now in progress it is possible to draw some preliminary conclusions:

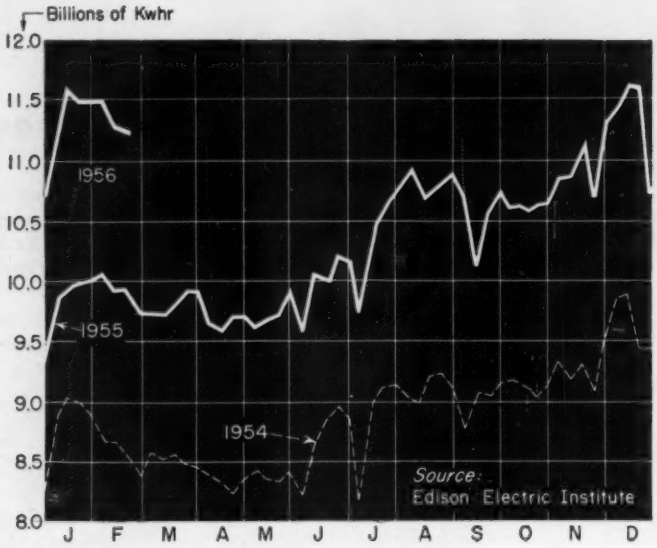
- The character of summer loads is changing. Load factors are higher. Minimum loads are higher on both a daily and weekly basis. Diversity is gradually dwindling between cables in the same duct bank.
- Traditional relation of summer to winter peaks no longer holds. Utilities serving large metropolitan areas in the North are reporting summer peaks near or above peaks of the previous winter.
- As a consequence underground service outages, cable failures, and cable duct temperatures have shown an accelerating upward trend over the past few years.
- These conditions are a warning signal for trouble ahead unless steps are immediately taken to meet or correct them.

With the possible exception of a few climatically favored areas, electric utilities are susceptible to the ravages of these heat storms both above and below ground. In many cases the effects reach clear back to the generating station where warmer condensing water limits load carrying capacity at the very time of higher summer peaks.

Utilities already hit by heat storms are going ahead full speed to lessen the effect of future storms to their systems. Union Electric Co of Missouri has about completed a $5-million program to reinforce its system. Commonwealth Edison Co is now programming $310 million for its transmission and distribution system to meet increasing loads and protect against unusual summer conditions. Other affected utilities have similar programs.

Utilities which have thus far escaped the dire effects of heat storms can profit from the experiences and examples of those which have felt their blasts.

ELECTRICAL WEEK



OUTPUT

Week Ended Feb. 18
11,321,000,000 Kwhr
Up 14.2%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 10.0%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Feb. 18	+14.2	+10.0	+6.7	+22.8	+8.3	+11.2	+14.5	+8.7	+23.1	+14.6
Feb. 11	+14.3	+10.5	+8.3	+22.2	+8.4	+11.7	+14.1	+10.0	+21.5	+13.1
Feb. 4	+14.9	+8.9	+7.1	+22.1	+10.8	+14.1	+15.0	+14.4	+21.1	+12.8

Seasonally Adjusted Index 215.4 Week Ago 214.2 Year Ago 188.4

Issue's Highlights—Industry representatives tell Joint Congressional Committee that private insurance companies' plans to cover nuclear installations are inadequate . . . Copper prices go up to 46¢ a pound . . . Eisenhower's Weather Control Committee finds rainfall can be increased 9-17% by cloud seeding . . . National Electrical Week observances held in many areas . . . Chart shows the federal legislative picture as it effects utilities.

Mexican Interconnection—Mexican subsidiary of American & Foreign Power—Compania Impulsora de Empresas Electricas—and Mexican Light & Power, last week completed interconnection of systems at Queretero, 100 mi north of Mexico City. This is believed to be first such interconnection between foreign companies in Mexico.

Heat Pumps in Florida—Florida Power and subsidiary, Georgia P&L last year added 1,165 heat pumps to system. With installations now in 2,427 commercial buildings and homes in its service area, company is believed to have one-third of all heat pumps installed in U. S.

Niagara Vote Proposed—Investors League, Inc, a "non-profit, non-partisan" group has written President Eisenhower; New York's Gov Harriman; Senators Ives, Lehman, and Capehart; Rep Miller; Robert Moses; and Jerome R. Kuykendall, suggesting that "to get more power, instead of more politics, out of Niagara," that the issue be decided by a free vote of New York citizens.

New Officers—I-T-E Circuit Breaker has announced following changes: G. E. Heberlein, formerly manager of Switchgear Division, becomes vice president in charge of engineering, succeeding William Deans who takes on other duties as vice president. L. H. Lipscomb, formerly with Bulldog Electric Products, becomes vice president in charge of sales. Succeeding Heberlein as manager of Switchgear Division is F. G. Schmidt, formerly manager of Small Circuit Breaker Division. W. P. Bolger, purchasing agent, takes Schmidt's former position . . . NEMA has named Russell Gingles director of public relations.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—Upper Colorado storage plan may be decided this week. House leadership plans to open floor debate on controversial plan as both sides claim new strength. Proponents claim elimination of Echo Park Dam has satisfied conservationists; opponents see farm block support on grounds project would add productive acreage at time of farm surpluses and also support of oil state Democrats in revenge for natural gas bill veto.

Atomic law institute is being set up in Washington. Bigelow Boysen, former AEC attorney in Idaho, has lined up faculty to help company officials acquaint themselves with radiation damage possibilities, records keeping, court procedures involving new atomic law. Course will cost $225 for 30 hours.

Black Hills P&L will build $3.5-million generating plant for Rushmore G&T Electric Co-op, with Rushmore REA loan. FPC has approved company's plan to lease and operate plant, reimburse Rushmore for principal and interest plus $600 a month expenses, and to supply up to 16,500 kw of demand each month.

Massachusetts Kills Bond Issue—Massachusetts Senate, by 21 to 14, has killed a bill to allow municipal electric and gas systems to expand plant by floating revenue bonds. Opponents of measure won by emphasizing the unfair competition of nontaxpaying publicly owned utilities; that bill would jeopardize municipal tax revenues; that revenue bonds, not backed by municipal credit, are more costly than regular municipal bonds because the interest rate of the former is higher.

Municipal Systems—Harrisonburg, Va., voters have rejected proposal by Virginia E&P to buy city-owned and operated electric system . . . Carolina P&L has asked Utilities Commission for authority to purchase electric distribution system of Grimesland. Sale has been approved by voters.

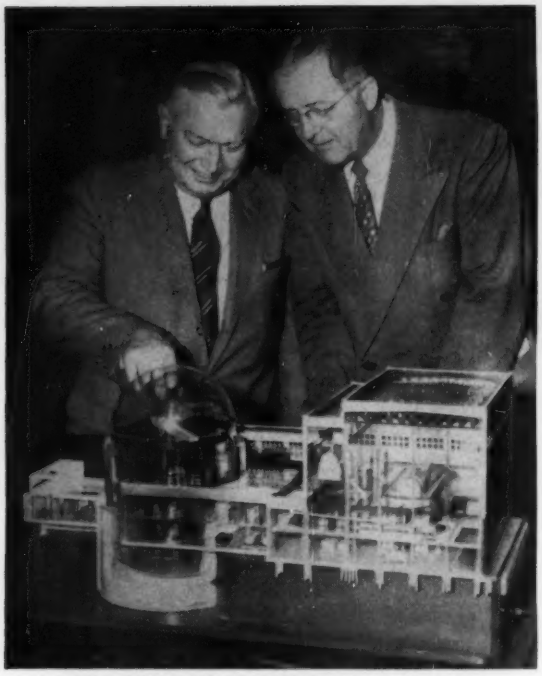
Legislatures and Commissions—Bill for state seizure of public utilities during strike has been introduced in Maryland legislature . . . Arkansas legislative study group doubts state can enact compulsory arbitration of labor-management disputes in public utilities because of conflict with federal legislation . . . Negotiated versus competitive sale of bonds has come up before Ohio PUC. Halsey Stuart & Co has intervened on proposed sale of $15 million bonds on negotiated basis by Toledo Edison to First Boston Corp.

ABOUT PEOPLE IN THE INDUSTRY

Dissatisfaction with manufacturers' pricing policies was expressed by George H. Cole, Alabama Power's purchasing manager, at recent NAPA utility buyers meeting. "Utility buyers are disappointed that there remains much to be done in establishing price adjustments and pricing on a more reasonably equitable basis," he said. Cole suggested that flexible pricing be limited to long-term deliveries, establishment of differentials justified by economies in cost of transacting business, and realistic price adjustment formulas.

Florida Power required 51 years to reach one billion kwhr sales but only five years to double figure for last year's record high, Pres W. J. Clapp notes in annual report issued last week. Construction will jump from $26.8 million last year to $33 million this year and $34 million each in 1957 and 1958. Clapp also notes that company's community development activities "have been steadily gaining momentum and have proved to be one of the finest public relations methods we have yet employed."

More News About People page 43



WALKER CISLER AND COMMITTEE HEAD ANDERSON

Atomic Insurance Called Inadequate

Industry leaders tell Joint Congressional Committee private insurance limits of $50-$60 million not high enough for third party liability

Leaders in the atomic power industry, meeting last week with the Joint Congressional Committee on Atomic Energy, scored current insurance plans for their proposed installations as inadequate.

Previously, the offer of private insurance companies to underwrite $60 million in third party liability insurance on nuclear power plants had been heralded as substantial by Washington leaders interested in the peacetime atomic energy program. Now, with the industry's view on the record, they are not so sure.

Disclosure of the failure of the private carriers to meet the unprecedented risks involved in atomic energy came when the joint committee, headed by Sen Clinton P. Anderson (D-N.M.), invited industry to report on progress in the civilian reactor field.

Willis Gale, chairman of Commonwealth Edison Co of Chicago, and Walker Cisler, president of Detroit Edison Co, appeared to testify, and William Webster, president of Yankee Atomic Electric Co, put his firm's stand in the record.

These three head multi-million dollar efforts in the atomic power field. All have rejected as unsatisfactory the limits that private insurance companies have set.

"The $50 million to $60 million of third party liability coverage which the insurance industry is proposing to make available is, I believe, more coverage than is in force to protect any existing industry in this country," said Gale. "For ordinary contingencies this insurance should be more than adequate. . . .

"What we are really concerned about is the extraordinary third party liability from a major nuclear catastrophe. The likelihood of a major nuclear incident is extremely remote, but, if it should occur, the potential damage might be extreme. . . ."

Webster put it even stronger:

"While we feel that the present capacity of the insurance industry to cover these risks is more than adequate to justify our going forward with the preliminary stages of our program, we doubt that adequate protection yet exists to justify our undertaking major construction expenditures."

The insurance industry began a study of the atomic problem last year. Not long ago, officials of the largest insurance associations determined the industry could afford to underwrite $50 million in plant damage risks and

WILLIAM WEBSTER

WILLIS GALE

a total of $60 million in third party liability, for each atomic installation. They made no decision on across-the-board requests, such as General Electric Co's reported proposal for a company-wide, $500-million policy to cover all its proposed atomic installations.

The figures when released evoked favorable responses in Washington. Appearing before the joint committee two weeks ago, Harold Price, director of the Atomic Energy Commission's licensing program, termed the amounts "substantial" and, like Gale, pointed out that they were the highest ever offered for industrial protection.

Members of the joint committee, too, felt more relaxed since the insurance companies had at last a price tag on the risk they could underwrite.

Government Insurance Looms

Congress finds itself still faced with a problem which had loomed large at the start of the civilian reactor program.

One of the prime reasons the AEC and joint committee fell in behind the insurance men was their loathing for a government atomic insurance program. Both AEC officials and the legislators agreed with the findings of the McKinney panel—the "citizens committee" appointed to advise the joint committee on the progress of the civilian program—that the government should avoid becoming involved in a massive insurance program to underwrite atomic risks. They believed that, given the proper encouragement and all the facts, the insurance industry would come forth with an adequate and workable plan.

Now, however, the spectre of a large federal mechanism to underwrite atom hazards has been revived by those in the vanguard of the civilian effort.

Industry's Withdrawal Implied

The statements from industry contained an implied threat: They would get out of the power reactor development business if something wasn't done. And they made no bones about indicating it would have to be big and done quickly.

"Our proposal to the commission and our contract with General Electric Co (for a 180,000-kw boiling water reactor) are conditioned upon the satisfactory solution of the insurance problem, at a reasonable annual cost, before the end of 1957," emphasized Gale. "Commonwealth, for one, cannot risk its solvency for a $35- to $40-million investment."

Webster termed the third party liability insurance question "the major unsolved problem" in the civilian reactor field.

Joint committee members explored one other possible solution to the impasse—a statutory limitation on a reactor owner's liability. Few opinions were expressed on this, but Gale did point out his company's fear that such a move would "concentrate the risk in the wrong place"—that is, a law setting such a limit would imply that only the reactor owner was responsible for third-party damage.

Private Atomic Plans Considered

In addition to insurance, which cropped up as an unscheduled topic, the reactor companies' witnesses delved into the financial and technological details of their private nuclear power programs.

Gale said the Nuclear Power Group, Inc, plans to pay General Electric $45 million for its boiling water reactor. No government aid is being requested. Of the total, Commonwealth Edison will pay $30 million, in addition to site and overhead costs. The Chicago utility will own and operate the plant, including its entire outlay in its utility plant account.

Leaving out the $15 million in research and development costs, Gale said, Nuclear Power Group estimates its boiler can produce electricity at an overall rate of 7.5 mills per kwhr—a cost "approximately competitive" with new coal-fired plants in Commonwealth's service area. Adding the $15 million, power costs would rise by one-third, to slightly more than 1¢ per kwhr.

NPG's Costs Allocated

Gale gave this breakdown of Nuclear Power Group members' contributions to the $15 million research and development costs:

Commonwealth, $2,833,334; American Gas & Electric Service Corp, $2,833,333; Pacific Gas & Electric Co, $2,833,333; Union Electric Co of Missouri, $2,000,000; Illinois Power Co, $1,500,000; Kansas City Power & Light Co, $1,500,000; Bechtel Corp, $1,000,000; Central Illinois Light Co, $500,000.

Cisler said Atomic Power Development Associates, Inc, has laid out a schedule which calls for spending $2 million before July on its Lake Erie site, six miles north of Monroe, Mich.; $270,000 for tests of the boiler for its fast breeder; $4 million for testing its full-size reactor and testing rotating shield and top closure, fuel elements, remote charging and discharging mechanisms, control road system, and sodium coolant loop.

Detroit Edison Co plans to ask the Michigan Public Service Commission to permit it to raise its contribution to a maximum of $6.5 million over a five-year period, Cisler said.

Fuel Cost Waiver Pushed

Cisler and Webster asked that consideration be given to waiving fuel charges beginning with the start of a reactor, such as has been provided for small-scale reactors under AEC's second-round demonstration program. (EW, Feb. 13, p 8). Big plants accepted in the first-round program, including the Detroit Edison breeder, are eligible for waivers of fuel charges for a seven-year period beginning July, 1955.

Cisler also took the opportunity to boost a Senate bill (S-2643) which would exempt from requirements of the holding company act companies whose sole connection with power generation was participation in a nuclear power station experiment. He said that when atomic power had been proved commercially feasible, and present experimental models were producing profitably, such a provision could be removed. Meanwhile, however, he declared an exemption is "indispensible."

What's Congress Doing of Interest to Utilities?

The answer appears on pages 48 and 49 of this issue where a rundown of Congressional bills pertaining to electric utilities and power policies appears.

The Congressional Scoreboard for Utilities, as it is called, records the following information for each bill: Number, sponsoring Congressman, explanatory remarks, and status at the time EW went to press.

In future issues of EW only that legislation which has changed status will be included in this special feature.

Copper Hits 46¢ per Pound

. . . as Anaconda, Phelps Dodge, Kennecott up price to 80-yr high after Chile asks boost nearer world market quotations

Anaconda Copper Co, Phelps Dodge Copper Corp, and Kennecott Copper Corp have boosted their prices of refined copper delivered to domestic customers to 46¢ a pound, 3¢ above the price level maintained by big producers since August.

The announcement by Anaconda followed a request by Chile's Minister of Economy for a 3¢ to 5¢ a pound increase on copper sold to American consumers. The request was directed to all American-owned companies operating in Chile. It stems from prevailing copper prices on the world market which have consistently been above those received in the U. S.

Herbert Barchoff, president of Eastern Brass & Copper Co, stated that federal policy had "contributed strongly" to the recent rise bringing prices to an 80-year high.

Last fall, he pointed out, the government had refused to release 100,000 tons of stockpiled copper produced in Chile.

The U. S., he explained, had begun stockpiling to aid the Chilean economy; since then, Chile has been diverting its copper from the U. S. to the world market and selling at highest obtainable prices.

If the U. S. had released the 100,000 tons last fall, Barchoff contended, "the cost would not be spiraling today and our economy would not be paying the price for it."

Copper companies have struggled to hold prices down to help boost the metal's use and meet growing aluminum and plastic competition. Costs have mounted, though, by 16¢ a pound since the start of 1955. Now the industry fears that copper may be pricing itself out of many traditional markets.

$53-million Copper Mine Proposed by Anaconda Co

Anaconda Co's Pres Roy H. Glover announced last week that $53 million will be spent for a copper mine program at Indio Muerto, Chile. Full production is expected by 1961 when the mine will yield 100,000 tons of copper a year.

Production will begin at about the same time Anaconda's nearby Potrerillos mine is shut down for anticipated exhaustion of high grade ore. A 15-mile electric railway will carry crushed Indio Muerto ore to Potrerillos mills for processing.

The Indio Muerto program calls for a five-mile tunnel with electric railway, a primary crushing plant, and hydroelectric power plants.

Westinghouse Reopens Talks

. . . with IUE, labor experts, federal mediators in 'all-out attempt' to settle strike

Westinghouse Electric Corp and International Union of Electrical Workers reopened negotiations last week with two impartial labor experts and heads of the Federal Mediation and Conciliation Service "for the purpose of making an all-out effort to effect a settlement" of the four-month strike.

Dr George W. Taylor, chairman of the War Labor Board during World War II, and David L. Cole, former Federal Mediation Service Director, have agreed to assist Federal Mediation Director Joseph F. Finnegan in the government-sponsored peace talks aimed at ending the strike which has idled over 50,000 workers.

The fact-finding board, proposed by Pennsylvania's Gov George M. Leader and four other governors, had previously been rejected by Westinghouse Pres Gwilym A. Price, who asserted that the company "cannot delegate to outsiders, with no responsibility to the company's employees or stockholders, the right to determine the fundamental terms of the union agreement under which Westinghouse must live for some years, and by which its competitive position is affected."

A Westinghouse spokesman has revealed that the back-to-work movement continues with about 125 employees returning a day.

The strike was labeled a "lockout" recently by the Pennsylvania Department of Labor and Industry, which granted 23,000 employees about $3-million in unemployment compensation. Westinghouse called this action a "highly improper and unjustified effort" to aid strikers in prolonging the dispute. The company announced plans to appeal the ruling.

State Niagara Plan Urged

New York State Attorney General Jacob K. Javits has warned U. S. Senate and House Public Works Committees he would fight in court any attempt to prevent State Power Authority's development of Niagara power. His memorandum criticized the attempt of five private utilities to develop the power potential, saying it would "limit or divest the rights of the people of the state in their natural resource."

Weather Research Shows 'Seeding' for Rain Works

President Eisenhower's Committee on Weather Control reported last week that cloud seeding can increase rainfall by 9 to 17% or more.

Headed by Capt Howard T. Orville, U.S. Navy (Ret), the committee also said that experiments indicate it may be possible to control hail and lightning storms and "modify" tornadoes, sources of frequent headaches for electric operating companies throughout much of the world.

Based on studies of five operations in Pacific Coast states, the report said that increases of rainfall by as little as 1% during growing seasons would pay for cloud seeding. Rain "increasing" rather than rain "making" method explored was the release of silver iodide smoke into the atmosphere from ground generators.

The committee's work, described as history's first scientific appraisal of man-made weather, may be continued for two more years if the President authorizes a request for additional research.

K. L. Neibauer shows you the new 400-ampere frame recloser, a 3-phase, heavy-duty unit, rated 15 kv; available also in a 280-ampere frame.

EXCLUSIVE!

New 400-amp recloser

to protect high load substations

Highest Capacity Recloser Provides 2-3 Cycle Opening, Fast Power Restoration

Now—and for the first time—Westinghouse offers you power restoring reclosers rated to 400 amperes, with up to 6000 amperes interrupting capacity. Developed to meet mushrooming system loads, this equipment is today's biggest bargain in low-cost fault protection.

Consider first the 2-3 cycle high-speed opening—you get much greater protection against line burn down. Consider also the dependable Westinghouse De-ion® arc quencher which gives you the fastest known arc extinction, the surest contact protection. Air dash pot timing, used on this recloser, is unaffected by temperature changes. And for convenience, a variety of easily set tripping sequences. Two more unique features of this high-capacity recloser are condenser bushings and bushing-type current transformers.

These are, of course, all Westinghouse exclusives—altogether a new concept of recloser protection—providing you with a recloser built to the quality standards of a circuit breaker. Through and through, simple design and rugged construction mean operational reliability you'd expect from 30 years of breaker design experience.

Call your Westinghouse sales engineer for full data on this outstanding equipment, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60877

YOU CAN BE SURE...IF IT'S

Westinghouse

Westinghouse

Helping the industry meet its growing loads

6 million kva of high-voltage transformers boost utility economy

At year's end, 53 extra-high-voltage power transformers in the 330-kv range had been bought by the utilities, from Westinghouse, to set an industry record of leadership for the third straight year. Of these, nearly 2,000,000 kva were produced last year, 2,750,000 kva were built in 1954 and more than 1,000,000 kva were made available in 1953. Most recently, two 400,000-kva autotransformers, largest in the world, capped this performance.

The challenge for this record—America's ever-increasing demand for electric power—is one that Westinghouse is proud to meet.

Westinghouse performance means, too, advanced design improvements *now* for bigger loads, higher voltages, increased system flexibilities *as they are needed.* Performance-proved innovations such as Form-Fit® design and Shell-Form construction; improved, forced-oil cooling; higher levels of insulation performance; and outstanding service from condenser bushings are Westinghouse "look-ahead" features . . . engineered to make conversion and transmission of large power blocks more efficient, reliable and economical.

Impulse testing of *all* these units on the production line is an added guarantee of trouble-free performance from the first split second on-line.

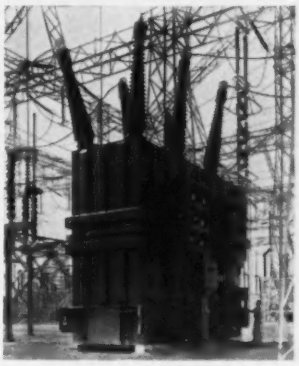
Higher goals are welcome at Westinghouse as milestones—on the way to equipping America's Utilities Today, for Tomorrow!

America's electrical needs are symbolized by this 400,000-kva autotransformer now in operation at the Tanners Creek plant of the Indiana & Michigan Electric Co. It is the greatest concentration of power conversion equipment in one unit ever applied to any system. J-97193

YOU CAN BE SURE...IF IT'S

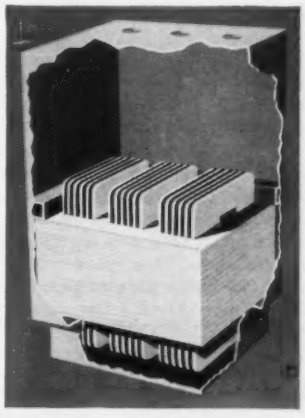
Westinghouse

At 400,000 kva . . . new, higher transformer capacity



The unique Westinghouse Shell-Form design means that coils are placed inside the core iron—natural, vertical cooling arrangement improves thermal characteristics; voltage oscillations are reduced for better dielectric qualities. This and other exclusive design features of Westinghouse extra-high-voltage transformers permit the same operating reliability and even greater system economies and flexibility as with equipment of much lower capacity.

Form-Fit design saves space, weight



Heart of the Westinghouse high-capacity, low-weight design is the Form-Fit construction. Snug-tailored, rugged, it reduces the volume and maintenance of coolant oil, permits upright shipment. It's a fact: Westinghouse Form-Fit transformers—in all sizes—are smaller and lighter per kva than any other design.

A wealth of experience in transformer design and production is available to you now through your nearby Westinghouse sales engineer; or write to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

ADVERTISEMENT

Highlights in development of pvc compounds for wire and cable

1932. Experimental work began.

1935. First commercial production, principally for signal and instrument wiring.

1938. Underwriters' approval in appliance lead wires.

1930-40. Underwriters' approval as Type T wire for rewiring jobs.

WORLD WAR II YEARS. Military applications: communications, power, electronics, signalling and others (including aircraft and shipboard);

Code recognition for use as Type T wire for new installations;

Underwriters' approval (1943) and NEC recognition as Type TW for wiring in wet locations.

1946-48. New applications and approvals: machine tool wiring, switchboard wiring, street lighting cable, cords, control cable, and many others.

1951. Acceptance by IMSA for police and fire alarm cable NEC recognition as TW wire through 2000 MCM; Underwriters' approval of Rome Synthinol 901 for 105°C. appliance wiring and, in

1954, approximately 100 million pounds of polyvinyl chloride compounds were used by the wire and cable industry.

CURRENT TRENDS

No. 4 in a series of articles

Progress report on polyvinyl chloride insulations

Since 1932, when researchers started investigating polyvinyl chloride compounds for wire and cable, it has become one of the most popular insulating materials available. In fact, over 100 million pounds were used by the wire and cable industry in 1954 alone!

To bring you up to date on polyvinyl chloride wire coatings and Rome Cable's product—Rome Synthinol® in particular, is the purpose of this brief report.

What are polyvinyl chloride compounds?

These compounds consist of polyvinyl chloride (or a co-polymer of polyvinyl chloride and polyvinyl acetate) thermoplastic resin mixed with plasticizers for flexibility, fillers for strength, pigments for color, and stabilizers for resistance to age and oxidation. The combined properties of these ingredients determine the properties of the compound. The compounds are thermoplastic in that they do not require vulcanization. They are generally applied to wire by the extrusion process.

Polyvinyl chloride compounds produced by Rome Cable bear the registered trade name Rome Synthinol®.

Characteristics of Rome Synthinol

Rome Synthinol has earned its popularity because of these desirable characteristics:

Economy—low in cost; and because of its small diameters, handling and installation costs are minimized

Simplicity—no outer braids required

Flame Resistance—inherently resists burning

High Dielectric Strength—higher than most rubber compounds

Moisture Resistance—superior to many rubber compounds

Appearance—bright, shiny colors

Weather Resistance—unaffected by long exposure to sunlight and weather

Versatility—suited to many low-voltage insulation and jacket applications—indoors or out, in conduit or duct, in water, or in the ground

Special compounds

Because polyvinyl chloride insulation and jackets derive their properties from the materials they contain, it is possible—through proper ingredient selection—to "engineer" compounds for specific end uses. Here are some of the special applications:

Cold—special compounds are available for low-temperature applications—down to 40°C. and lower

Heat—special compounds are available for high-ambient conditions—up to 105°C.

Deformation—special compounds, or special cable design, can reduce this effect

Moisture—most polyvinyl chloride compounds have very good moisture resistance. But careful selection is advised if dc potentials are involved in wet locations.

Polyvinyl chloride insulation should not be used where heavy and/or frequent current overloads are involved (such as in network cable). And because of relatively higher dielectric losses, it is not generally recommended for the higher primary distribution voltages.

Specifications

The various polyvinyl chloride wire and cable industry specifications in use today are: Underwriters' Specifications; ASTM D734; IPCEA Appendix I for insulation, Appendix J for sheath; Federal Specification JC-129; IMSA Specification No. 20.

There are also, of course, many individual customer specifications applicable for specific end uses.

Typical applications

Rome Synthinol and other polyvinyl chloride materials are suited for these wire and cable applications:

Type TW building wire
Nonmetallic sheathed cable
Type UF underground feeder cable
Machine tool wire
Station control cable
Series street lighting cable
Multiple street lighting cable
Multiple conductor instrument wiring
Fire alarm and traffic signal cable
Over-all jackets
Fixture wires
Radio hook-up wire
Appliance wires

Further developments

From its active and pioneering part in the development of polyvinyl chloride compounds, Rome Cable's experience is reflected in Rome Synthinol Cables. Special Rome Synthinol Compounds are available for many unusual applications.

A notable example is Rome Synthinol 901, the first high-temperature polyvinyl compound to receive appliance wire listing for 105°C., and later approved for use on TW moisture-resistant building wire. Because of other outstanding properties—increased resistance to oils, solvents, and chemicals—Synthinol 901 has proved itself as a preferred insulation material for chemical, petroleum, and other industrial wiring where high temperatures and environmental hazards are a continuous problem.

If you have a wire and cable problem for which a polyvinyl chloride compound might provide the answer, our experience is at your service.

ROME CABLE CORPORATION, Rome, New York

National Electrical Week

FEBRUARY 5-11, 1956

an expansion of the observance of Edison's Birthday, February 11.

ITS AIMS

To remind Americans:

1. Of the benefits of electricity to our personal way of life and to our economy
2. Of the need for safe, adequate wiring
3. Of our debt to the brilliant pioneers of the electrical industry.

PLACECARD FOR BANQUET, PART OF ST. LOUIS CELEBRATION SPEARHEADED BY M. E. SKINNER

National, Local Fanfare Marks NEW

- **Nationwide radio, television shows salute the 1st annual celebration**
- **St. Louis, in typical observance, unfolds week with varied activities**

National Electrical Week, observed nationally for the first time Feb. 6-12, was saluted over radio and TV broadcasts as St. Louis and other towns and cities rolled out their own red carpets to give the national send-off a local punch.

Salutes to NEW were sounded over Allis Chalmers Manufacturing Co's radio program, National Farm and Home Hour, and on the following television shows: General Electric (Co) Theater, Westinghouse Electric Corp's Studio I, and Beat the Clock, sponsored by Sylvania Electric Products, Inc.

National Proclamations Issued

In addition Secretary of Commerce Sinclair Weeks and Albert M. Cole, Housing and Home Finance Agency administrator, set NEW up on a national scale with official proclamations.

In St. Louis, the week's observance was punched out with the following activities:

- Mayor Raymond R. Tucker issued a proclamation calling for the city to celebrate NEW.
- Merrill Skinner, chairman of national NEW committee and vice president of Union Electric Co, spoke on the National Farm and Home Hour radio program to point up the important part played by electricity in the American way of life.
- St. Louis Electrical Board of Trade held a joint luncheon meeting with the Chamber of Commerce (See placecard above). Fischer Black, EW's editor and publisher, was guest speaker. More than 600 attended.
- Home Building Forum, sponsored by Union Electric Co, held two evening meetings each attended by 400 electrical contractors, architects, builders, bankers, and others interested in home financing.
- A closed-circuit telecast to 77 cities announced plans for the national Live Better . . . Electrically campaign (p 51). For the occasion, 375 representatives from various segments of the industry assembled.
- Special sections in two daily newspapers were devoted to NEW.
- Displays at the annual Home Builders' show tied in with observance of the week.

Farm Electrification Stressed

Uses of electricity on the farm and the development and industrial activities that have made rural electrification possible were stressed by Skinner in his radio broadcast.

Fischer Black, in his address before the Electrical Board of Trade and Chamber of Commerce meeting, declared that the all-electric home is within the realm of probability—not just possibility—for everyone. An all-electric home, he pointed out, consumes ten times more electricity than the average U. S. home but costs no more than owning an automobile.

The closed-circuit telecast was designed to present the promotional Live Better . . . Electrically program to branches of the industry so all will be in the swing of activities when a national television hook-up presents the program to the public in April.

In towns and cities throughout the nation programs similar to that in St. Louis were sponsored by utilities and other segments of the industry to commemorate NEW.

NEW Group Collects Reports

Reports of the week's observance in all areas are being collected by the national committee, with headquarters at 290 Madison Ave., New York 17, New York. These reports will aid the committee in planning the celebration next year when even greater nationwide attention is expected.

In addition to Chairman Skinner, other NEW committee officers include Vice Chairman Col. S. R. Todd, president of International Association of Electrical Inspectors (612 N. Michigan Ave., Chicago) and Secretary Arthur W. Hooper, executive director of National Association of Electrical Distributors (290 Madison Ave., New York City).

EDISON MEDALIST L. A. Umansky (left) receives congratulations from C. A. Adams, AIEE president in 1918, while Pres M. D. Hooven shows medal. Prof Adams, who is second oldest living AIEE president, gave a paper on magnetic materials

AIEE Looks to Tomorrow

SYSTEM Engineering

Power system engineers plan for industry expansion by studying results of early facilities and probing apparatus design

Engineering Editors of Electrical World

Seldom in recent years has the technical program of a meeting of the American Institute of Electrical Engineers concentrated on specific engineering problems vital to the future expansion of the utility industry with such intensity as did the Winter General Meeting at New York earlier this month.

About evenly divided among sessions on generation, transmission and distribution, transformers, and system engineering were reports of fundamental studies that touched deeply on matters of future apparatus design and performance of pioneer power system facilities.

In the main the news was good with very little to suggest serious difficulties in bridging the gap between today's designs and those envisioned for the next decade.

Conclusions to be drawn from the sessions were these:

- Generator sizes of 300 Mw are being proved in for major metropolitan systems.
- Machines of 500 Mw using liquid cooling techniques are practical for future systems.
- Ability to dissipate heat no longer controls physical size of generators.
- Trend to use of economic dispatch continues.
- Early high levels of RI and lightning outage rates on 330-kv lines have had negligible effect on successful operation.
- High lightning outage rates on 330-kv lines puzzle authorities.
- Steep front surges, the single shield wire, and structure height were mentioned in theories advanced to account for high 330-kv lightning outages.
- Charging currents are acknowledged to set distance limitation for use of EHV cable.
- Performance tests on 138-kv lead-covered and pipe cable provide clues to EHV cable design.
- Proposed two-step reduction in insulating levels of power transformers met objections from users who feel knowledge of switching surges is insufficient and reliance on arresters too great for reliability.
- Most distribution engineers agree that new load areas should be served at higher primary voltages but find conversion to higher primary voltage is hard to justify.
- Battle on higher secondary voltages for residences continues.

The details of these and other developments of engineering interest at the sessions follow.

Engineers Study Use of Large Generators

- **Con Ed finds 300-Mw generators to be most economical size**
- **Steam-driven boiler feed pumps economical for large stations**
- **Liquid-cooled windings make 500-Mva generators possible**
- **Heat-dissipation no longer controls physical size of generators**
- **Pump-turbine justified despite 26% additional expenditure**
- **High-speed printing annunciator aids hydro operation**

Unit capacity addition studies by M. J. Steinberg and V. N. Cook indicate that 300-Mw units are the economic size for the Consolidated Edison System. However, they said that economic justification for the selection of a 300-Mw unit was influenced in part by the absence of material differential investments for transmission facilities. Otherwise this could be the criterion for the selection of smaller size.

Savings in annual fixed changes which 250 and 300-Mw unit additions gave represented from 83 to 93% of the total differential investment which could be justified for them. Estimated investment for a supercritical-pressure unit exceeded the justifiable amount according to these studies.

Steam Drives Favored

Savings in initial investment, increased station output, and better station heat rates are factors that make steam-driven boiler feed pumps attractive for today's large generating units. However, some restrictions were placed on the economic advantage of the steam turbine for this type of service in a study prepared by A. G. Mellor, R. C. Muir, J. F. O'Mara and J. F. Ransom, all of GE.

It showed that: Turbine drives cannot be justified on investment cost alone unless a single, full-sized turbine drive with no spares is considered. And it is not economical to install more than two turbine drives per generating unit as the installed cost of two full-sized turbine drives is about a standoff with three half-sized units.

Inrush Current Still Problem

Discussions strengthened the authors' view that the power requirements of the boiler feed pumps present station designers with an auxiliary power supply problem as unit size and steam pressure increases. However, J. P. Fitzgerald, Cleveland Electric Illuminating Co, warned that inrush current requirements cannot be solved by removing the boiler feed pump motors from the auxiliary bus because large loads still remain on this bus.

Discuss Armature Design

Liquid-cooled windings easily permit armature designs of 500 Mva rating in 3,600 rpm machines. Larger capacities are undoubtedly possible, C. E. Kilbourne and C. H. Holley, GE, predicted in describing the liquid-cooled armature windings for the 260-Mw generator for East Lake Station of Cleveland Electric Illuminating.

Transil oil was chosen as the liquid coolant because of its high dielectric strength, good cooling properties, chemical inertness to insulation, and its well-documented history of use in electrical apparatus. Heat removal ability of this substance is 21 times that of air and about five times that of hydrogen at a pressure of 45 lb. Leakage tests made with transil oil indicate that conductor insulation would not be affected even by a large leak in the copper conductor.

Another paper on generator cooling by B. M. Cain and Dean Harrington of GE showed conductor-cooled generators to have such excellent heat-dissipating ability that this factor no longer need limit the physical size of machines as it does conventionally cooled machines.

Uniform Temperature Possible

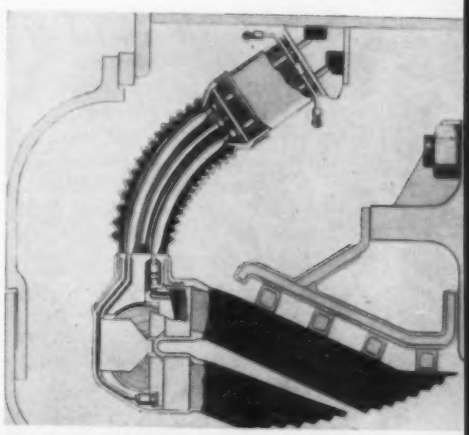
The gap-pickup principle (design which scoops up cooling gas from the air gap to cool the windings at the center portion of the generator rotor, makes it possible to build a simple conductor-cooled rotor with minimum ventilating power losses, according to D. M. Willyoung, GE. Such a rotor will have an approximately uniform temperature rise over its full length and the lowest possible winding resistance and excitation power loss consistent with rotor stress limits, regardless of the rotor length.

TVA to Get Pump Turbine

Because studies indicated that a satisfactory return on the 26% additional installed cost of a pump turbine would be realized, this type of hydraulic machine will be installed as Unit 2 at Hiwassee Hydro Plant of Tennessee Valley Authority, according to L. R. Sellers and J. E. Kirland, Jr. A single-speed combination was used as it was not considered advisable to design a pole-changing, two-speed, synchronous-type unit for this 80,000-hp machine. The speed selected is a compromise between best speed for pumping and best speed for generating. Reduced-voltage, normal-frequency motor starting will be used.

A high-speed printing annunciator is used at the new Sir Adam Beck Plant of Ontario Hydro, according to J. R. Leslie and G. M. Keyser of the commission. This system replaces the conventional annunciator system completely. It writes down the operations of 540 points and lists time, name, and operation (closing or opening) at the rate of 10 points per sec.

Design of the instrument is based largely on recent advances in computer technology. Memory circuits are used to facilitate the high-speed printing. First production model of this equipment cost about $75,000.



ARMATURE BARS are connected hydraulically to the inlet and outlet headers. Liquid passages are contained in the electrical insulator connection

Today's Load Scheduling Problems Examined

- **Quantitative effects of weather included in new forecasting method developed by Ontario Hydro**
- **Dispatch computer will do better job with less confusion**
- **Kansas City P&L installs dispatching system for 12 units**

A new approach to forecasting daily peak loads is being tried on the system of the Hydro-Electric Power Commission of Ontario, which accounts quantitatively for weather effects. Starting from the premise that illumination is the chief weather factor determining the irregular variation in weekday peak loads, the two-step forecasting scheme correlates weather variables with illumination and illumination quantitatively with peak loads.

This system, described by D. K. A. Gillies, B. Bernholtz, and P. J. Sandiford, has resulted in accurate predictions 24 hours in advance of the generation required to meet load fluctuations influenced by weather. A performance analysis over ten months showed mean error to be 1.3 and no error larger than 4.5%.

What Do Losses Cost?

In tackling the question, "What do losses cost in hydro, thermal, and combined systems," V. W. Ruskin of British Columbia Electric Co said:

1. Average cost per kwhr should not be used for loss evaluations as it includes elements of production costs that are fixed irrespective of kwhr produced. Because loss evaluations concern future projects, future incremental cost per kwhr should be used.

2. For pure hydro and thermal plants the incremental cost per kwhr can be estimated readily by listing elements of production cost and allocating them on some reasonable basis.

3. In combined hydro and thermal systems Ruskin distinguished between thermal stations operated year around and those operated only part of the year. Year-round thermal stations should use the incremental cost per kwhr of thermal generation only. Part time stations require a weighted incremental cost per kwhr.

Computers Described

Several authors from West Penn Power Co and Westinghouse described, in two papers, design principles and application of the economic dispatch computer on the West Penn System. The conclusion of an investigation by the authors indicated that:

1. Computer can be fitted into the general plan of dispatching very efficiently without adding operators. It will do a better job with less confusion, in fact.

2. Loss formulas and techniques for the computer are sufficiently accurate.

3. Although principal function of computer will be in dispatching, it can be used for studying the best combination of units for certain load cycles.

The device is independent of the load and frequency control system so that it indicates directly the economic dispatch at anytime, after one has set into it the constraints on the system and the desired total generation. Manual operation will be used at first so that operating force will have an opportunity to evaluate the equipment to see whether modifications in procedure are necessary.

West Penn Power Co authors were: W. H. Osterle, H. W. Colborn, and W. R. Hamilton; Westinghouse authors were R. B. Squires, R. T. Byerly, and E. L. Harder.

A new automatic dispatching system recently installed by Kansas City Power & Light Co for control of 12 generators in three stations was described by K. N. Burnett, D. W. Halfhill, and B. R. Shepard, GE. Routine work by dispatching personnel is eliminated by control of a power system directly to a condition of optimum economy by means of a control signal directed to all units in terms of incremental cost.

Heart of the system is an electronic function generator which contains:

1. Analog of incremental heat rate of each machine.

2. Means to establish high and low maneuvering limits.

3. Fuel cost adjustments.

W. H. Phillips, Philadelphia Electric Co, described various methods used in allocating savings from pool interchange. He pointed out some weaknesses of these methods and described a method for use in power pools involving more than three companies. The method specifically recognizes the contribution of individual companies. The method involves much arithmetic which Phillips points out can be readily performed by the digital computer. Each company merely indicates kwhr interchange and its replacement value on mark-sensed cards which are processed along with the cards of all other companies for each hour.

(*More AIEE Meeting Report page* 22)

L. F. HUNT, Southern California Edison; J. B. Hodtum, Allis-Chalmers Manufacturing; E. R. Hendrickson, Commonwealth Edison; E. V. Sales, Consumers Power

The Big News for '56

KUHLMAN, ORIGINATOR OF *"Quick Grip,"* INTRODUCES A

New High Voltage Bushing

FOR RATINGS ABOVE 5000 VOLTS

Now, KUHLMAN affords new safety, new convenience and new speed in handling high voltage connections on cover bushings of pole type transformers.

In 1939, KUHLMAN introduced the first "Quick Grip" Bushing for 5000 volts and below. The principle of this bushing has, since then, been adopted by most of the country's leading transformer manufacturers. Linemen all over the world prefer KUHLMAN "Quick Grip" Bushings . . . no tools are necessary . . . no live parts are exposed . . . connections are simple, safe and fast. Check all these advantages:

Easy Installation –the line lead is simply inserted into the hole in either side of the bushing . . . a twist of the knob completes the job!

Complete Protection—the protective knob reduces effects of weather, corrosion and the possibility of animals and birds disrupting service.

Versatile Application—new cover type "Quick Grip" will soon be available on all pole type distribution transformers. Accommodates full range of EEI-NEMA wire sizes.

Your KUHLMAN representative will be happy to explain this high voltage "Quick Grip" Bushing . . . it is another KUHLMAN feature that has provided new standards of distribution transformer service and long life for America's leading utilities.

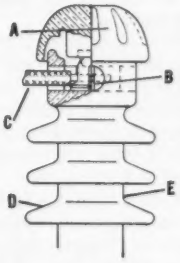
A—Hard rubber cap protects — simple clockwise rotation clamps lead firmly.

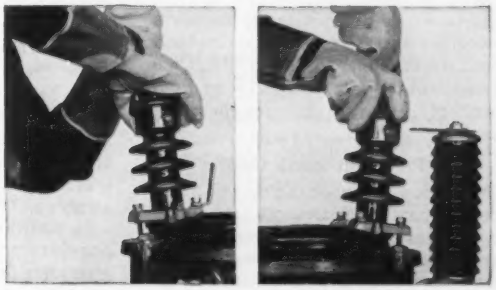
B—Gap Electrode

C—Line leads . . . can be entered from two sides.

D—Porcelain.

E—Corrugations provide ample creepage distance.

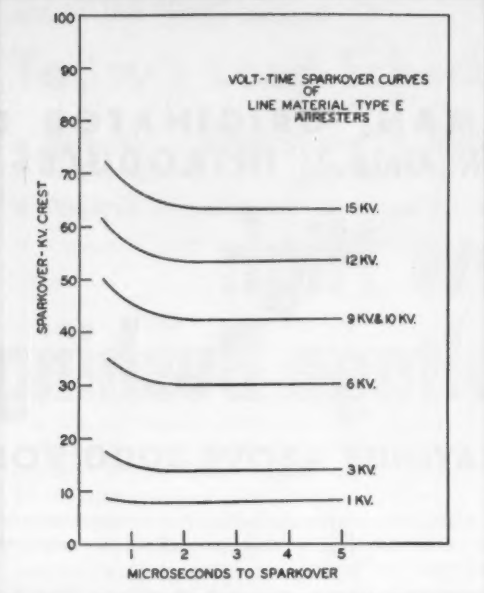




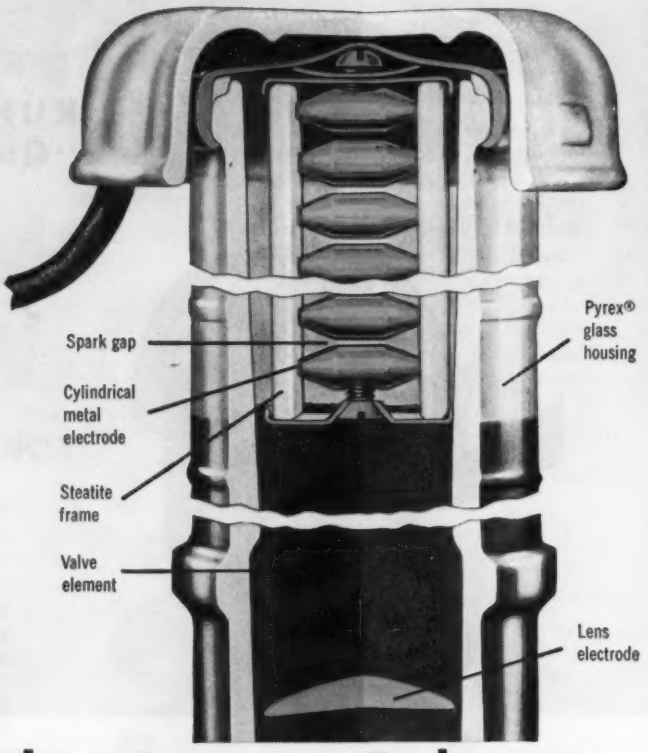
Conventional or CSP Application

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA



Volt-time curves of arrester sparkover on impulse. These curves illustrate the quick response of the arrester to lightning surges. At all points of the curve the impulse sparkover of the arrester is far below the insulation strength of the distribution equipment being protected.



How L-M's Type E Valve Arrester Balances 60-Cycle Sparkover and Impulse Sparkover

By **GEORGE W. COOPER**
Manager
Protective Equipment Sales
Line Material Company

L-M's Valve Arrester spark gap is designed to prevent unnecessary 60-cycle sparkover of the arrester to harmless switching surges, whereas the low and consistent impulse sparkover brings the arrester into operation quickly and dependably in case of a dangerous lightning surge.

Precision Spark Gap

The spark gap is made of electrode members, accurately spaced and supported by a strong machined frame of high-grade steatite. The gap is so designed that its 60-cycle sparkover value is approximately 1.8 times the rating of the arrester under wet conditions. This is sufficient to keep normal switching surges from sparking over, and provides a path to drain off higher switching and lightning surges.

At higher surge voltages the combination of the metal electrode and the steatite produces an instantaneously ionized, electrically fast path. This combination, together with the cylindrical design of the electrodes, forms a ladder gap unit with a low impulse sparkover.

High Discharge Capacity

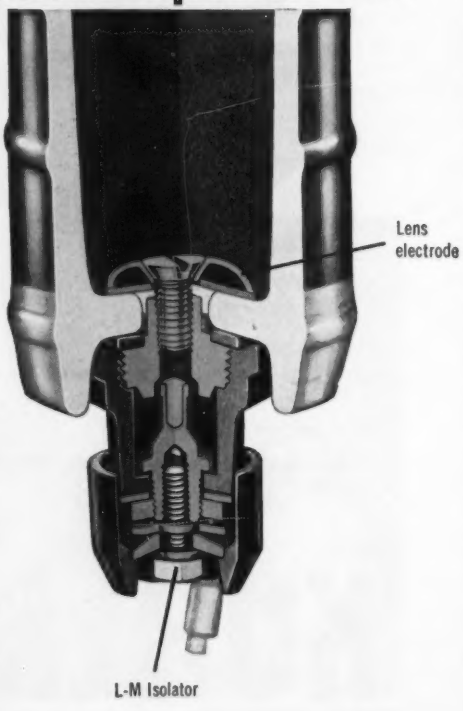
L-M's exclusive bonded valve element combines low IR drop with more than enough capacity to handle the 65,000-ampere surges prescribed by NEMA. It acts as a valve to limit power follow current to a negligible value.

The result of all these features is that the L-M Type E arrester is outstanding in the protection it provides, in its long life under severe lightning conditions, and in its permanent, never-changing characteristics. L-M valve-type arresters amply meet all NEMA standards.

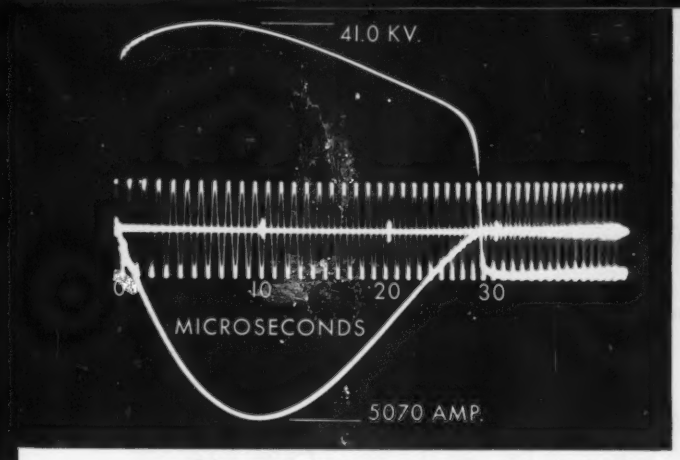
In addition, L-M's "ISOLATOR" provides positive assurance against grounding feeders, by disconnecting the ground lead from the arrester, if the arrester should ever become damaged.

Get This Bulletin

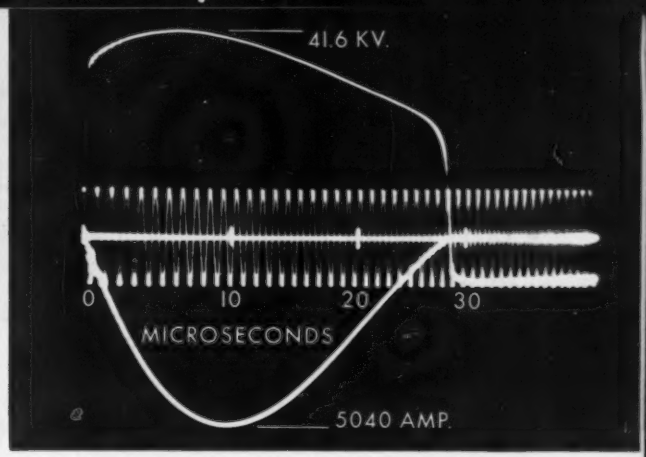
Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer for a copy of Bulletin LA2; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



LINE MATERIAL Lightning Arresters



Before test: Oscillogram illustrates the electrical characteristics of an L-M 9 kv arrester before the AIEE Operating Duty Cycle Test of thirty operations using a 5000 ampere surge and 60-cycle follow current at the rated voltage of the arrester.



After test: Oscillogram of electrical characteristics of the same arrester after AIEE Operating Duty Cycle Test, illustrating the unchanging high degree of protection that is maintained throughout the life of the arrester.

How L-M's Type E Valve Arrester Provides Low IR Drop, High Discharge Capacity

By **GEORGE W. COOPER**
Manager
Protective Equipment Sales
Line Material Company

L-M's exclusive design of valve arresters provides the optimum amount of valve material to give balanced performance. The valve material must provide a low impedance path for surge currents to assure low IR drop, provide ample surge current capacity, and function as a valve to limit follow current until it is interrupted by the series gap.

Several factors contribute to the high discharge capacity or ability of the Type E arrester to handle heavy strokes of lightning without damage.

L-M's Molded-in Valve Element

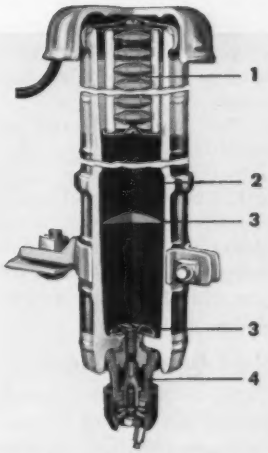
"Granulon," the valve material, was developed as the result of years of experience and research in distribution-type arresters. It is able to withstand severe heating which accompanies heavy strokes of lightning. The "Granulon" is mixed with a special non-charring, inorganic, glass-like binder; then molded directly into the glass housing at high pressure to form a hard, dense mass with outstanding discharge capacity and valve-action properties.

Lens-shaped electrodes are placed in the valve element to counteract the lightning surge current "skin effect." These electrodes have been scientifically designed to produce a multiple-path distribution of the surge current throughout the valve element, thus increasing the discharge capacity of the element and assuring long, uniform life.

Assures High Capacity

The characteristics of L-M's valve element combine optimum performance features with outstanding protection and long arrester life. These characteristics are retained permanently without change caused by aging or service.

In addition, the "Isolator" provides positive assurance against permanent fault to ground by disconnecting the ground lead from the arrester if the arrester should ever become damaged.



1. The ladder spark gap is designed to provide a perfect balance between 60-cycle sparkover and impulse sparkover.

2. "Granulon," the valve material, is able to withstand severe heating which accompanies heavy strokes of lightning.

3. Lens-shaped electrodes in the element counteract "skin effect" of surges, assuring even distribution of the discharge throughout the valve element.

4. L-M's "Isolator" gives positive assurance against grounding feeders by disconnecting the ground lead from the arrester if the arrester should ever become damaged.

Electrical Characteristics of Type E Valve Arrester

KV Rating	Minimum Impulse Sparkover 1½x40 Wave KV Crest	Front of Wave Sparkover KV Crest	IR Drop Across Arrester				
			1500 Ampere Surge	3000 Ampere Surge	5000 Ampere Surge	10,000 Ampere Surge	20,000 Ampere Surge
1	8	8	4 KV	4.5 KV	5 KV	6 KV	7 KV
3	14	17	11 KV	13 KV	14 KV	16 KV	18 KV
6	30	33	22 KV	25 KV	27 KV	31 KV	35 KV
9	42	49	33 KV	37 KV	41 KV	46 KV	53 KV
10	42	49	37 KV	42 KV	46 KV	52 KV	59 KV
12	53	60	44 KV	49 KV	54 KV	60 KV	67 KV
15	63	70	55 KV	62 KV	66 KV	74 KV	85 KV

(On wave rising 100 kv per microsecond per 12 kv arrester rating; 10 kv per microsecond for 1 kv arrester.)

Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer, or write for a copy of Bulletin LA2, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL *Lightning Arresters*

Lightning Outages on 330 Kv Unexplained

- **High outage rates on 330-kv lines puzzles lightning experts**
- **Other medium voltage lines with single shield wires also experience phenomena**
- **Theories center around effects of steep front surge, single shield wire, and high structure height**

Unexplained high lightning outage rates experienced during the past two seasons on 330-kv transmission lines of the American Gas & Electric Co and OVEC systems as well as on 138-kv transmission lines at the Commonwealth Edison Co stimulated keen interest in papers on lightning.

Although no universally acceptable explanation for the high outage rates has been yet advanced, theories center around steep-front lightning surges, the fact that the lines involved were shielded by a single rather than twin ground wires, and that structure heights were somewhat higher than usual.

The high outage rates were experienced in sections of the AG&E 330-kv system while it was operating at 138 kv. This 330-kv line with 150-ft towers and 18-unit strings of insulators experienced an outage rate comparable with an adjacent 138-kv line with 100-ft towers and 10-unit strings of insulators.

Short Duration Surges

Charles A. Miller, Ohio Brass Co, pointed out that the nature of glaze burns on insulators suggested lightning voltage pulses having extremely short duration. This leads to the conjecture that a lightning surge reaches a crest voltage far in excess of the critical flashover voltage of the insulator string and that it flashes over in a fraction of a micro-second.

In a late supplement appended to his paper, Dr Miller offers a curve comparing tower-top voltage curves with insulator volt-time curves for the 100 and 150-ft towers. This curve, reproduced herewith, shows that the peak of the tower-top voltage curve for the 150-ft tower intersects the volt-time curve of the 18-unit string at 0.3 micro-second. The peak of the curve for the 100-ft tower misses this volt-time curve by an amount which is far in excess of the difference in tower-top voltages because of their difference in height alone. From this consideration Miller reasons that increasing tower height produces two factors which affect flashover of insulator strings:

1. Increase in peak tower-top voltage because of the increased travel time of the alleviating voltage wave returning from the tower base.

2. Increase in time at which the peak voltage occurs, which means that the tower-top volt-time curve may intersect the insulator strings at a much lower voltage.

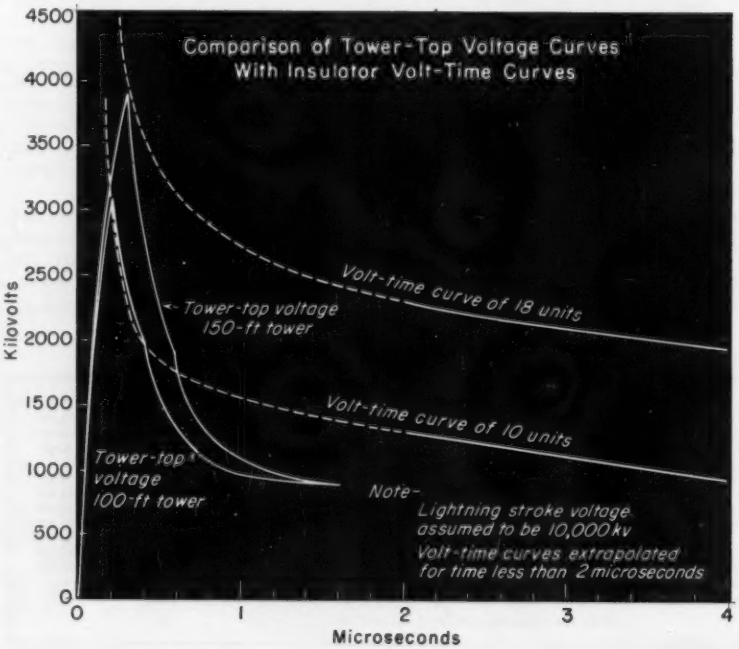
This second factor may have considerably more effect on causing insulator string flashover than does the difference in tower-top peak voltages resulting from their differences in height, Dr Miller believes.

H. M. Ellis, Ontario Hydro, pointed out that Miller had apparently neglected bound charge coupling of the ground wire and phase wires and suggested that with two overhead ground wires phase conductors would be better shielded from gound charges than with a single ground wire.

Similarly R. W. Caswell, Commonwealth Edison, questioned the shielding ability of a single ground wire against steep-front strokes. He noted that the trip-out rate per 100 miles per year was 2.1 for two ground wire line, otherwise similar in design to the 138 kv of his company which has experienced a rate of 24 tripouts for 100 miles per year. Edwin R. Whitehead, Illinois Institute of Technology, expressed the conviction that the induced voltage theory long since scrapped be re-examined, as Ellis's discussion suggested.

A transactions paper analyzing the potential of a transmission tower top when struck by lightning was presented by E. S. Koncel, Commonwealth Edison. The paper sought to develop the wave form of tower top potential for a direct stroke to the tower. It presented an approximate method of solution that gives good results when compared with the comprehensive method.

(*More AIEE Meeting Report page* 24)



what happens when a cutout fires?

When a distribution cutout blows, it blasts flame and "shrapnel"—the severity depending on the magnitude of the fault. A lineman is exposed to this hazard if he inadvertently closes a cutout against a fault. Imagine yourself hanging on, part way up a pole, closing an ordinary cutout . . . how much chance is there to get away?

CONE OF "SHRAPNEL"

Or suppose, instead of just blowing, the cutout is inadequate and fails—perhaps explodes!

These hazards are more significant with today's higher short-circuit currents. They are hazards no lineman should be asked to face as an unavoidable "calculated risk." Here is why:

- The S&C Positect has interrupting ratings high enough to meet every fault condition on a typical distribution feeder, yet it is priced in line with normal duty cutouts.
- It is designed and tested for closing against a fault —"make" as well as "break."
- Its interrupting ratings apply to closing in on a fault—not just clearing it.
- It is mounted so that the blast is directed away from the operator.
- Kickback is prevented by the high inertia of the fuse tube as it is driven home, directly opposing the recoil forces.
- Blast is minimized by arc shortening and freer venting.

For detailed information about the Positect, write for Catalog Section 520.

CROSS SECTION OF EXHAUST FROM A CONVENTIONAL DISTRIBUTION CUTOUT

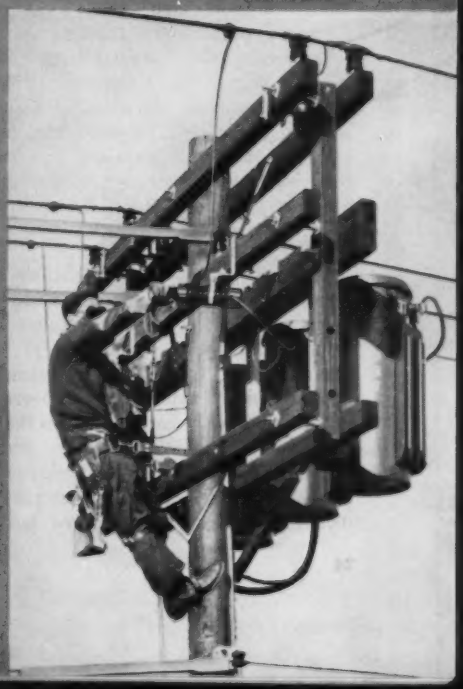
This is what happens when a cutout blows:

1. Hydrocarbons are ejected in an incandescent state . . . conducting non-condensible gases of high heat content. They fan out over a wide area and travel a considerable distance, depending on the magnitude of the fault.
2. Molten metal and metal particles (pieces of cable, element terminals, etc.) are ejected with great force in a narrow scatter pattern.

In a typical operation (4000 amps at 2.4 kv) a ball of flame 4½ feet long and 2½ feet across is discharged from the fuse tube and travels at high velocity. Metallic particles make a "shot" pattern 12 inches in diameter on a 1-inch pine board target four feet below. The force of the blast is indicated by the fact that the "shrapnel" penetrates from ¼ to ¾ of an inch into the board.

When a cutout explodes almost anything can happen!

Closing a Positect is so safe that a hook stick is unnecessary. Most linemen do it by hand.



Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

Review Early Performance of 330 Kv

- **High RI and lightning outages have had little effect on successful operation of 330-kv lines on AGE and OVEC systems**
- **Aging of conductors, care in stringing, and shift in phase position on double circuit structure cut radio interference**
- **25,000-Mva breaker performs consistently and without restrike in line dropping test. Could have been returned to service**
- **Combination of power and potential transformer function saves $100,000 for 330-kv bank. Applicable also above 161 kv**

Discussion of the operating experiences on the 330-kv transmission lines of American Gas & Electric Co and the Ohio Valley Electric System centered around five papers during a special session. Papers dealt with lightning and corona performance, line dropping tests on a 330-kv circuit breaker, operation of a combination power and potential transformer, relay protection, and sleet melting.

Reports of lightning and corona performance of 330-kv lines of the AG&E and OVEC Systems were contained in a paper by W. S. Price, S. C. Bartlett, and E. S. Zobel, AG&E. They disclosed that when the Sporn-Muskingum 330-kv circuit was energized, radio influence measurements were higher than had been anticipated. As corrective measures conductor diameter was increased from 1.6 in. to 1.75., the amount of saturant in the paper filler was reduced, special precautions in stringing were taken to protect the wire from abrasion, and finally sharp corners were eliminated from the surfaces of hardware. Radio influence has been further reduced approximately 40% on double-circuit structures by putting like phases of each circuit on the same transmission arm and so reducing the voltage stress to the surface of the conductor.

Lightning Outages High

The authors also reported that line lightning outages have been considerably in excess of those predicted using industry-wide methods of prediction. The OVEC-IKEC system flashed over at a rate of 8.2 flashovers per 100 miles per year; many times the predicted rate of 0.5 flashovers per 100 miles per year for an isoceraunic level of 45. Discrepancy between predicted and actual performance has prompted reexamination of the mechanism of transmission line flashovers from lightning—a subject which received searching analysis during other sessions of the winter general meeting. Because wave shape is advanced as important as lightning characteristic upon which complete data is lacking, wave slope indicators are now being built for installation on the OVEC system during the 1956 lightning season. Meanwhile, neither lightning nor corona has had a serious effect on successful operation.

Breakers Measure Up

Details of circuit breaker performance under extensive line dropping tests on the OVEC 330-kv system were reported by Otto Naef, AG&E; and R. E. Friedrich, Westinghouse Electric Corp. A total of 103 3-phase operating interruptions were made involving 42, 114, and 185 miles of line. Interruptions by a 330-kv, 2,000-amp, 3-cycle, 25,000-Mva "watch case" oil circuit breaker were completely restrike free. The breaker performed consistently and after test was found to be fit for continued operation without further maintenance.

Network Saves Meter Pot

Another innovation on the 330-kv lines of OVEC and AG&E was the application of a network to a power transformer to compensate for voltage transformation errors. In this way an accurate representation of 330-kv bus potential to be used in metering was obtained. Design, testing, and operation of such a potential compensating network used with a power transformer was described by E. S. Pugh, AG&E, and T. G. Gerwing, Westinghouse. This combination saved an estimated $100,000, on a 3-phase bank of 1175 BIL, in the authors' opinion. Authors believe it can be economically applied on systems operating above 160 kv at the present state of the art.

Relay protection for the OVEC 330-kv system described in a paper by H. C. Barnes, A. Hauspurg, and J. H. Kinghorn, all of AG&E, sought to achieve the most rapid possible clearing under all fault conditions using only tired and proven relay elements. The authors reported that under normal operating conditions all line faults would be cleared by carrier current or first-zone relays. Relay time for 3-phase or phase-to-phase faults varies from 0.7 to 1.2 cycles. Phase-to-ground fault relay time varies from 0.7 to 1.4 cycles. Majority of line fault tripping can be initiated by first zone back up relays in maximum of two cycles. Relay time for remote second zone faults is 30 to 35 cycles.

Sleet Melt Takes High Kva

For sleet melting on the AG&E-OVEC systems, currents required are in the order of 1,200 and 1,800 amp. As such currents at 330 kv represent line loadings of 700,000 and 1 million kva, they are beyond the capabilities of the present system. Consequently the melting current is obtained by energizing predetermined links of 330 kv and grounding the far end.

Experience with the arrangement was reported in the paper by C. F. DeSieno, C. A. Imburgia, and G. H. McDaniel, all of AG&E. They pointed out that it may not be possible at all times to meet the conditions required to permit sleet melting on all lines. Sleet prevention methods during this expansion period are the alternative. The authors suggested that a present solution to sleet melting on the 330-kv system may eventually be simplified by developing high frequency ultrasonic methods of removing sleet or by devising a conductor material or coating which would prevent ice from adhering to its surface.

Galloping Motion Complex

Conductor galloping has been traced by Ontario Hydro engineers to self-excited unstable aerodynamic characteristics. A paper, co-authored by A. Madeyski and presented by A. T. Edwards, reported field observa-

tions and tests on a span with wax applied to simulate ice. Conclusions were that motion is vertical, horizontal, torsional, and translational. Torsional motion is believed to increase probability of galloping.

Vibration of conductors is caused by the oscillating nature of wind flow around them, asserted R. E. McHugh, Jr, University of Washington, in a paper prepared jointly with F. B. Farquharson. Wind tunnel tests show that surface roughness has little effect on power derived from the wind, with all data falling on a curve which agrees closely with field observations.

Resort to electrical-mechanical analogies to match dampers to the Aeolian vibration characteristics permits pre-determination of performance which closely conforms to field observations. According to J. S. Thompkins, Alcoa, in a paper prepared jointly with L. L. Merrill and B. L. Jones, vibration occurs when the alternating force imposed by steady transverse wind approaches the frequency of some node of the conductor span.

Transmission should be expanded at the highest voltage in the economic range to gain greater flexibility and economy in the future, asserted A. J. Wood, General Electric Co, in a paper prepared jointly with J. M. Henderson. Their conclusions were:

1. Higher voltage can be justified superposed on 115 to 161-kv systems for distances over 50 mi where load is sufficient.

2. Bundled conductors offer economy as well as reduced radio interference.

3. Lowest cost for energy at 50 mi is attained with 230 to 330 kv. Greater distances justify higher voltages, 330 to 440 kv at 100 mi and 400 to 500 kv at 200 mi.

Studies Guide Future EHV Cable Designs

- **Performance tests indicate that both stresses and temperatures of LP oil-filled and HP pipe cable can be increased**
- **Cable with thin tapes are predisposed to thermal failure**
- **Charging current needs of EHV-cable are seen as setting distance limitations on their use**
- **Current ratings of multiplex aluminum cables determined experimentally are 9% higher than calculated**

HERMAN HALPERIN, Commonwealth Edison; W. L. Everitt, Univ of Illinois

THE 5,000TH RESISTANT, the first in AIEE history, was G. O. Perkins, I-T-E

Results of an investigation in the performance of experimental 138-kv cables and accessories conducted in cooperation with manufacturers were hailed as containing clues to future EHV-cable design. Reported by Herman Halperin of Commonwealth Edison Co, they pertained mainly to low-pressure, oil-filled, lead-covered cable and to high-pressure, oil-filled, pipe-type cable and accessories.

Each cable manufacturer furnished experimental cable with two different insulation thicknesses; at least one of these thicknesses was below standard. The thinnest linen-paper tapes were 8 mils thick, the thinnest kraft paper tapes 3 mils thick. The pressures in the pipe and in the oil-filled lead-covered cables were maintained at 200 psig and 8 psig respectively.

Conclusions of the investigation follow:

1. Stresses and temperatures for both low-pressure oil-filled cable and high-pressure oil-filled pipe-type cable may be safely increased above values heretofore used.

2. Cable with conductor shielding may be operated with maximum stresses up to 300 v per mil, average stresses to 175 vpm.

3. AEIC temperature limits for 138-kv operation may be safely raised to increase load ratings by about 10%.

4. Cables with thin linen paper tapes are pre-disposed to thermal failure at high temperature.

5. No serious mechanical deterioration of tapes results from high temperatures except for the thinest linen tapes.

6. Pipe cables showed signs of serious electrical deterioration in the outer insulation.

7. Limited tests showed straight kraft papers have no superiority for joint taping over crepe paper.

8. High power factors in the outer portion of some pipe cables and in terminal insulation of both types of cable emphasize the need for care in avoiding contamination of EHV cable and accessories during manufacture and insulation.

Recognition that charging current of high voltage cables can set a limit to their use to extend transmission systems has posed new problems for system engineers. Recent investigations of this phenomenon, spurred by need for a 20-mi circuit, were reported by W. C. Marble, Philadelphia Electric,

Critical Length Drops for Higher Voltage Pipe-Type Cable

Circuit Kv	Rating Mva*	Charging Mvar per Mi.	Critical Length, Mi.
66	110	1.8	61
132	200	4.5	44
220	300	8.6	35

* For 2,000 MCM, 0.5% dielectric pf, 85% daily loss factor, 25 C earth.

Study EHV Cable

(*Continued from page* 25)

in a paper co-authored by C. S. Schifreen. Their conclusions included these:

1. Maximum power capability of EHV cable drops rapidly with length.

2. Transmission distance limits for high-voltage cables are much less than for lower voltage.

3. Each design of cable has a definite critical length beyond which it is restricted to power transmission at lagging pf. Such cables may be thermally overloaded by dropping load or boosting load pf.

4. Charging current of cable may be used to supply kvars to the system. Additional vars can be transmitted through the cable only when it is shorter than its critical length and then for reduced loading.

5. A long high-voltage cable extension of open-wire transmission must be checked for voltage rise under open circuit conditions.

Discussion by R. J. Wiseman, Okonite Co, observed that the present trend toward higher electrical stress on cable insulation only aggravates its charging current limitations. But ability to permit higher operating temperatures offers appreciable gains. R. W. Burrell, Consolidated Edison Co, noted the increase of dielectric losses for cable above 69 kv which gives 380-kv cable less kv capability than 230 kv. E. R. Thomas, also Con Ed, suggested that EHV cable may force transmission to use lower frequencies or dc to cut both dielectric losses and charging current.

Proposals to use aluminum sheaths for oil-filled cable require new determinations of oil demands and pressures, contended J. H. Neher, Philadelphia Electric in a paper prepared jointly with F. H. Buller, General Electric Co, and F. O. Wollaston, British Columbia Electric Co.

New progress was reported in determining the influence of steel pipe on the ground fault impedance of pipe-type cable. A wholly theoretical analysis by Dr C. A. Adams, consultant, developed a "trapezoidal" method for computing the penetration of electromagnetic radiation.

TV Interference Poses Minor Problems

TV interference from power circuits is uncommon on the Ontario Hydro System despite prevalence of fringe area reception, reported J. R. Leslie in a paper prepared jointly with P. W. Waddington. Noise, when it does develop on wood pole lines, is usually caused by loose hardware or suspension insulators supporting jumpers. When 30-in. crossarm braces develop poor contact at the pole, a fraction of line voltage causes frequent sparking in a configuration which forms a half-wave dipole at about 100 Mc to disturb the entire VHF band. Some of the spark energy is also induced into line conductors and may cause some RI.

TVI Solutions

Noisy ball-socket joints are cured with auxiliary contact springs. Graphite compounds were found to give only temporary relief. Loose or corroded tie wires have caused interference, but untreated pin insulators contribute little TVI despite their reputation for RI.

Discussion by Paul Taylor, Central P&L, revealed similar experience in Texas except that 30-50 Mc radio equipment has helped to locate TV interference sources. And J. M. McCutchen disclosed that standard REA designs can radiate on TV channels 4 and 6 from loose or corroded hardware and in the broadcast band from energy induced in span wires.

Line Design A Factor

Line design, wind, and precipitation are major factors in transmission system radio and TV intereference, reported Prof H. H. Newell, Worcester Polytechnic Institute, in a paper prepared jointly with F. W. Warburton, New England Power Service. Tests on a selected group of lines from 33 to 230 kv indicate three types of discharges which cause RI; these are metal to air, metal to porcelain, and metal to metal. Only the latter two generally cause TVI, which accounts for observed differences. The 230-kv line showed variable low intensity; its RI was greatly increased by rain but no TVI was noted. A 69-kv suspension line on steel cross arms had higher RI in fair weather which was quieted by rain; again TVI was negligible. And a pin-type 69-kv line also showed high RI which was decimated by rain; it also had TVI which followed the same pattern. No wood-crossarm line with 8 or more discs showed TVI.

Microwave Symposium

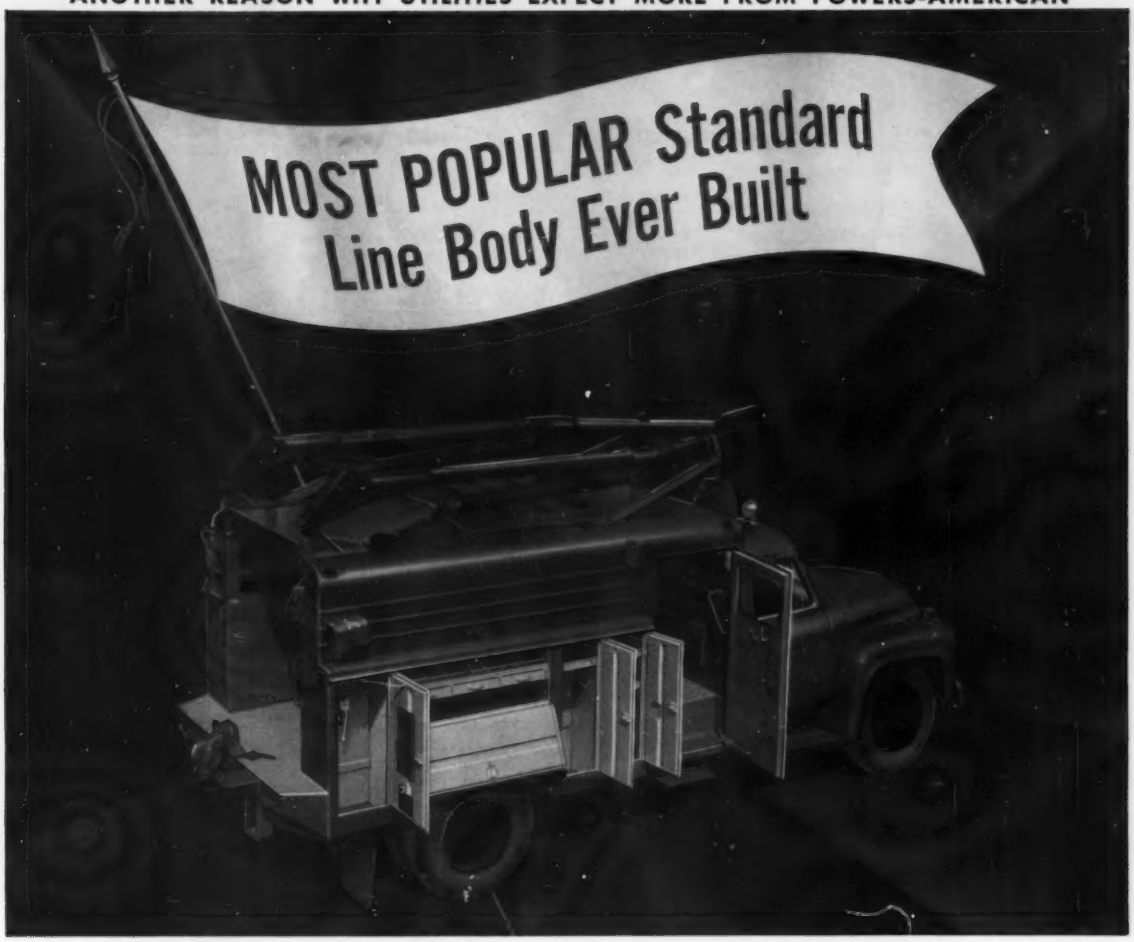
Feature of the carrier current session was a symposium and round-table discussion on the application of microwave equipment to power systems. Equipment users reported satisfactory results. W. J. Wortman, Duke Power Co said that maintenance expense on the equipment for his company was 60¢ per channel mile per month. He cited tube replacement costs of $5.42 per station per month for 960-megacycle equipment.

L. E. Ludekens, Southern California Edison Co, suggested that the same men who install the microwave equipment maintain it. He reported good results with standby power supply engines using propane fuel.

G. E. Farmer, TVA seconded L. E. Ludekens on his use of propane for fuel and his suggestion that the same men follow the equipment through from installation to operation.

(*More AIEE Meeting Report on p* 30)

ANOTHER REASON WHY UTILITIES EXPECT MORE FROM POWERS-AMERICAN



POWERS American® Series 800-C

LINE CONSTRUCTION AND MAINTENANCE BODY

"Isn't that a custom-made body?" That's what utility men often ask when they see the pace-setting 800-C. And, it's easy to understand why . . . for here's a body with more "most-wanted" features than any *standard* model on the market. Features such as partitioned sliding drawers, extra shelves, extra bins, "full-opening" doors, and 56″ wide cargo area . . . just to mention a few.

Crews really go for the 800-C crew compartment—with its easy-riding seats, adequate leg room, and well-ventilated comfort in winter or summer.

Available in lengths of 11′, 12′ 3″, and 13′. . . or without crew enclosure, in 11′ and 12′ 6″ lengths. Can be furnished with any *Pole-Master* Hydraulic Derrick or with conventional derrick equipment.

✦ Descriptive literature and prices will be sent on request

The Series 800-C Body shown here is equipped with a *Pole-Master* PM-2 Hydraulic Derrick . . . one of three different Pole-Master Derricks available in sizes for handling poles from 40′ to 75′ in length.

Powers-American Division

McCABE-POWERS AUTO BODY COMPANY

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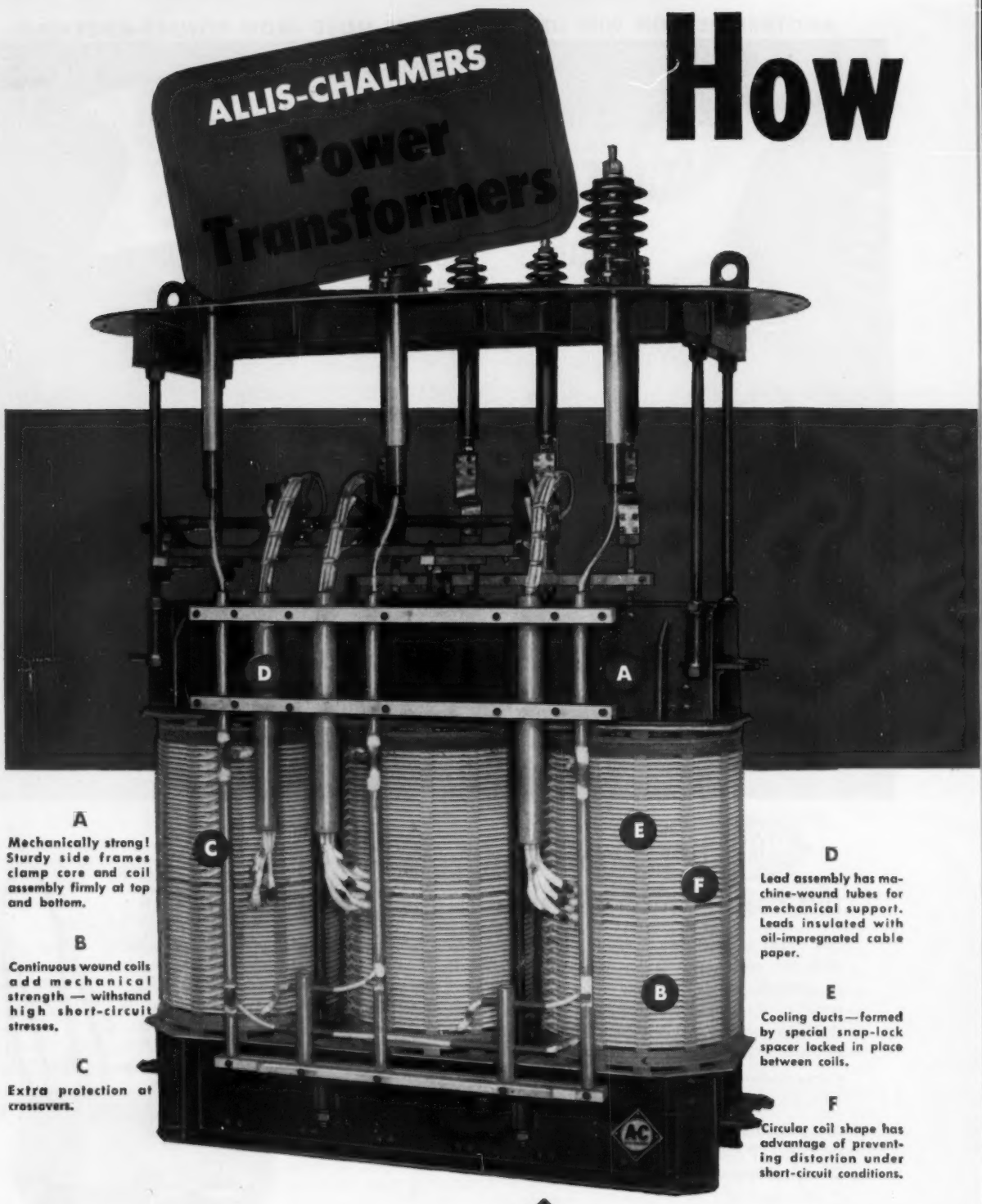
How



A

Mechanically strong! Sturdy side frames clamp core and coil assembly firmly at top and bottom.

B

Continuous wound coils add mechanical strength — withstand high short-circuit stresses.

C

Extra protection at crossovers.

D

Lead assembly has machine-wound tubes for mechanical support. Leads insulated with oil-impregnated cable paper.

E

Cooling ducts—formed by special snap-lock spacer locked in place between coils.

F

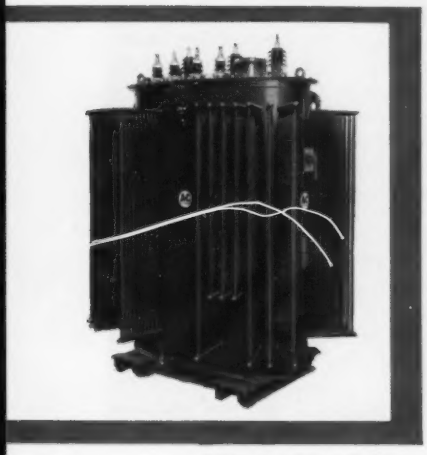
Circular coil shape has advantage of preventing distortion under short-circuit conditions.

A-C ALLIS-CHALMERS

ALLIS-

Balanced Design Works for You

Here's a combination of design features that adds up to *balanced design*... long transformer life



No single feature is all-important in transformers! But together they mean *balanced design* — all the things you want and need in a transformer.

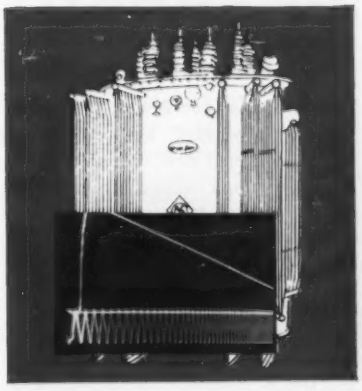
- **High impulse strength**
- **Corona-free construction**
- **Quiet operation**
- **Reduced size and weight**
- **Dependable performance**
- **High short-circuit strength**
- **Rugged mechanical construction**

In balanced design, every feature must contribute its full share to the operation. No feature can outweigh another — each must complement the other.

For example — of what value is "light weight" if it cuts performance? With balanced design you get both light weight *and* efficient performance.

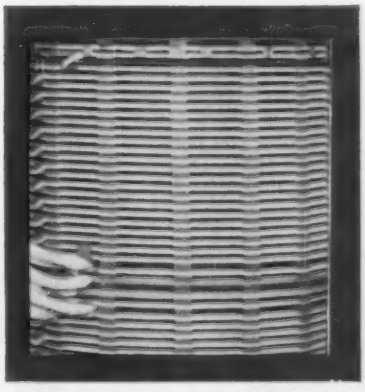
Get complete information. Call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Three features of balanced design



1. Corona-free design. Repeated lightning and switching voltage surges may be applied to the transformer without damage, up to full values as defined by standards.

2. Reduced size and weight. This means higher rated transformers are easier to handle — can be moved without removing radiators and bushings.



3. Proper coil design plus static shields and interleaved coils where needed provides high series capacitance, as well as more uniform voltage distribution.

CHALMERS A-4955

2-Steps Lower Transformer BIL Discussed

- **Proposed 2-step reduction in transformer BIL based on improved insulation structure, better performance of oil.**
- **GE reports successful performance of 12 transformers in 138 and 230-kv operation with 2 steps lower BIL since 1952.**
- **Reduction in BIL would cut costs about 10%, reduce losses and impedances.**
- **Main objections to reduction in BIL is greater reliance on arresters and lack of knowledge of switching surges.**
- **Better design of control for transmission substations has reduced cable costs 80%.**

Imminent prospect of a two-step reduction in the insulation level of power transformers rated 138 kv and above dominated discussion at several sessions.

The consensus appeared to be that such a 2-step reduction had been "expected" for some time. But its inauguration drew counsels of caution and warning that there is insufficient margin to protect the transformer against the unknown magnitude, duration, and wave shape of switching surges and 60-cycle fault voltages. Discussers agreed generally that lightning impulse voltages today pose no great threat to reduced insulation protected by modern arresters.

A new type of insulation assembly for power transformers that contributes to insulation strength and, in combination with modern arresters, permits a further reduction in insulation level was reported by E. G. Adolphson and F. G. Vogel, Allis-Chalmers. The use in transformers can bring a reduction in losses, lower impedances, and a 10% cost reduction as between 161 and 180-kv class for 230-kv.

H. L. RORDEN, American G&E; C. J. Slatt, Bonneville Power Adm; H. A. Cornelius, Commonwealth Edison

Moreover, a study of coordination showed that 161-kv insulation transformers with the new assemblies can be protected by 182-kv arresters, even with 200-ft separation. A test was also made on a 15,000-kva, 92-kva class transformer with 121-kv arrester, such as might be used on a 138-kv system. The arrester consistently held switching surges below 185 kv.

Service Good for 12 Units

Lynn Wetherell disclosed that GE's recent announcement of a 2-step reduction in transformer BIL's is based on good performance of 12 transformers in 138 and 230-kv operation since installation in 1951 and 1952. Two steps down is reasonable and attractive where 75% arresters can be used for systems 138 kv and up. Economy rests, he said, in applying the 2-step reduction to phase-to-ground insulation and holding phase-to-phase insulation to a 1½-step reduction. Wave shapes of switching surges and the characteristics of insulation in withstanding them are reasonably well understood. Modified oil-test procedures using a round gap, rather than one with square edges have demonstrated ability of oil to stand up in reduced insulation transformers.

W. H. Eason, GE, called for a change in standards to drop the spark postential of arresters below 1.5 times rating. He called for a standard test wave that could be used in establishing the switching surge strength of transformers. H. L. Rorden went one step further in favoring adoption of a test wave of the same shape in evaluating performance of both arresters and transformers. Why use a 1½ x 40 ms wave for one and a 10 x 20 ms wave for the other, he asked. Cost savings with reduced insulation are worth the loss of an occasional arrester, Rorden said.

Bellaschi Urges Caution

In an evaluation of the problem presented by reducing insulation at the higher voltages below the already reduced BIL's, P. L. Bellaschi made these points in a conference paper:

1. If impulse protection were the sole consideration, insulation levels could be further reduced—say from 825 BIL to 750, 1,050 to 900, and 1,175 to 1,050.

2. But a further lowering of insulation level would place almost complete dependence on the arrester under switching surges. Loss of the arrester would expose insulation to lightning and leave it vulnerable to switching surges over 2.4 times line-to-ground crest value.

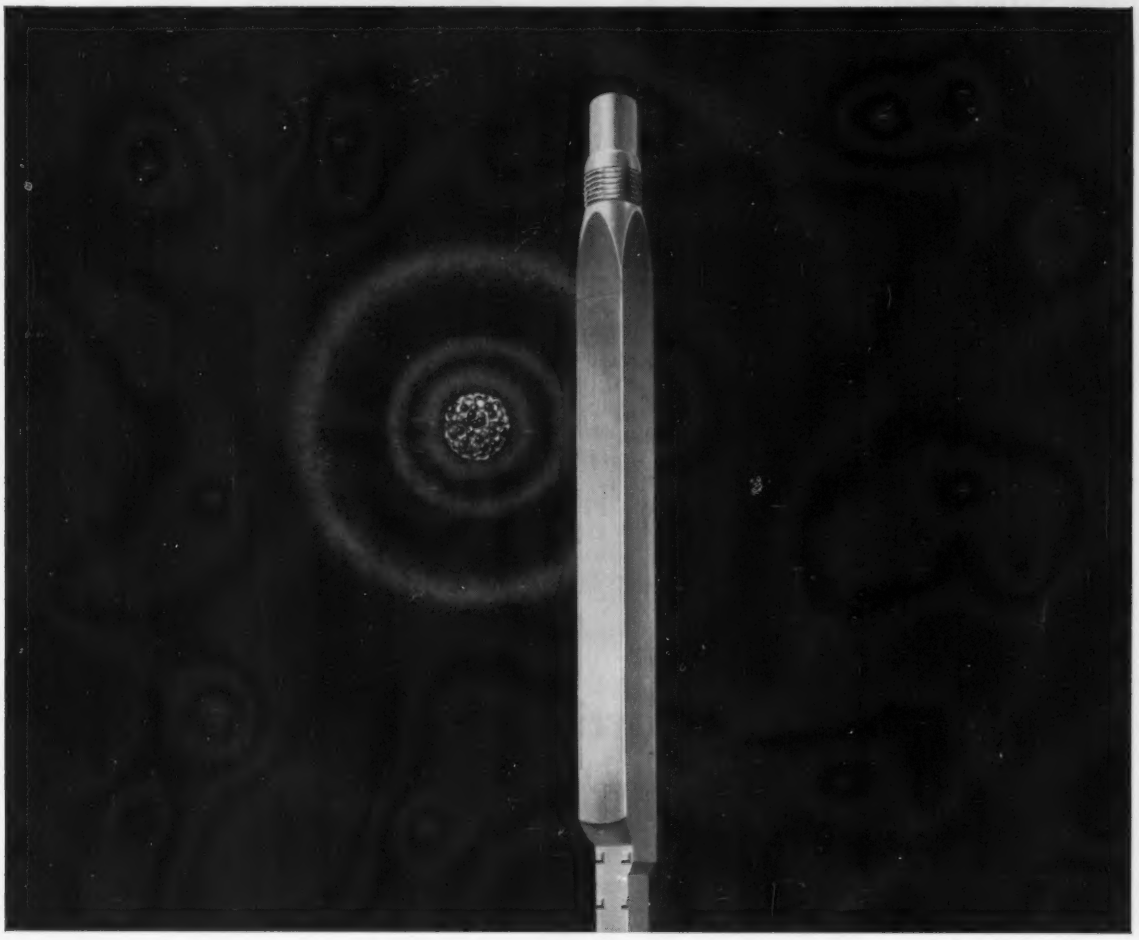
3. Moreover, reducing insulation level also places increasing emphasis on normal frequency stresses which increase 30% with reduction in BIL from 1,050 to 825 for 230-kv systems.

In discussion, R. Langlois-Berthelot, Electricite de France, observed that in France breaker operations have produced over-voltage coefficients of 3.0 to 3.5. He expressed belief that switching surges offer no threat to insulation cable of withstanding 360 kv for 1 minute. Breakdowns because of switching are practically non-existent, he said. C. W. Miller, Westinghouse, observed that utilities can ill afford reduction in insulation levels unless risks are balanced by savings.

Switching Surges Need Study

H. A. Cornelius, Commonwealth Edison, said that until more is known about switching surges, it is unsafe to risk loss of transformers by use of a 92-kv class transformer on a 138-kv system. There is no assurance that the arresters will withstand switching transients, he said. The transformer might thus be left without lightning protection if an arrester failed. J. A. Ten Brook, Philadelphia Electric, also cautioned against reducing insulation more than one step without more knowledge of switching surges. Savings he said should be weighed against the risk. He estimated cost savings to be 11½% for 1 step; 6% more for 1½ steps, and 5% more for 2 steps.

(*More AIEE Meeting Report page* 32)



REACTOR FUEL . . .
from research to packaged power

Atomic energy promises to solve age-old fuel supply problems in overseas countries. Consequently, the "Atoms for Peace" program is a doorway to the world for manufacturers and operators of research and power reactors.

In any reactor, the efficient utilization of nuclear fuel depends greatly upon the design and construction of the *fuel element*. Shape, size, mechanical structure and degree of enrichment all play a part in extracting maximum energy with minimum fuel cost. Finally, the *reprocessing* of used fuel elements requires expert knowledge and specialized equipment.

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Lower BIL Discussed

(*Continued from page* 30)

But others were more confident. Switching surge and long duration voltage tests of transformer insulation led W. C. Farneth and F. J. Vogel, Allis-Chalmers, to conclude that transformer insulation can be designed to withstand continuously 90% of the one minute test value. Thus they reasoned that large service margins would exist even with lower test voltages for transformers.

Their tests indicate the ratio between switching surge strength and one-minute strength is a minimum of 1.25. On the basis of this, switching surge strength would be 3.1 times normal line-to-ground even with a low-frequency test voltage of 2.45 times normal line-to-neutral.

Tests by General Electric indicate about the same ratios, J. R. Meador disclosed. But because of variation in results many more tests are needed to determine accurately the precise ratios. C. W. Miller, Westinghouse, said that the low-frequency test might be even lower than 2.45 times normal voltage. However he cautioned that further reduced insulation should be approached cautiously because of possible increased hazards.

W. E. Elliott, F. G. Vogel, and D. N. Hiu showed that in aging tests on oil at 105C, decomposition products are not eliminated by flushing them away with nitrogen as has been previously believed. On the contrary, such flushing, they found, actually accelerates oil deterioration. Their conference paper pointed out that varnish contaminates oil whether products are flushed with nitrogen or not.

A new design for control of transmission substations, 110-38kv, 15 to 30 Mva, has cut cable costs alone by 80%, reported G. M. Mulhern and D. W. O'Neill, Electric Supply Board of Ireland. Such savings resulted from:

1. Using adequate but minimum size control cables with plastic insulation.

2. Adopting telephone-type cable for 24-v dc signalling circuits.

3. Installing common instrumentation with single-elements.

4. Moving protective relays from control room to high-voltage cubicles.

As a result of short-circuit tests on a 138-kv substation bus, a new factor has been added to a basic equation for calculating mechanical forces, said D. W. Taylor and C. M. Stuehler, Public Service E&G. This new factor "k", for equations of the paper, gives results that are more accurate and not so conservative for phase-to-phase faults on single-phase bus.

Battle on Higher Distribution Voltage Goes On

- **Mass conversion to higher voltage primaries cannot be justified; it costs much more than 4-kv expansion**
- **But some engineers report savings by conversion**
- **Agree new areas should have higher primary voltages**
- **The 265/460-v system is cheaper when diversified home peaks exceed 1.6 kva**
- **Savings with this voltage at heavier loadings might permit favor UG service in residential areas**
- **Primary service to each home is more costly than conventional overhead distribution**

Distribution engineers at the winter general meeting heard what was probably the most complete coverage ever given to primary and secondary voltage. Speakers and many discussers covered primary voltage from all angles and then probed secondary voltage problems.

Distribution for Boston Edison's lowest density suburban area should remain at 4 kv, advised L. J. Weed. Despite the 13.8 kv widely used for subtransmission, economic comparisons indicate that conversion of existing 4 kv for 10 years' growth in the 117-sq-mi area would cost $300,000 more. Cumulative carrying charges of a 13.8-kv system during this period would be almost double those of extending the 4 kv. Additional disadvantages would be lower service reliability from use of larger circuits and the need to equip and train crews for hot-line work.

Support for Weed came from Philadelphia Electric in a paper by H. G. Dallas and J. W. Gallagher. Their investigations, spurred by heavy air-conditioning loads and anticipation of heat pumps, covered a low-to-medium density suburban area and a heavy density central business district. Conclusion was that converting the 4-kv suburban distribution to 13.2 kv would incur a penalty of $9 million in annual charges to 1970. Converting the 2.3-kv 2-phase business district to 13.2 kv would boost annual charges by $12 million, but the more conservative change to 4-kv would save $½ million.

Perhaps a major part of present distribution would have been at higher voltage, contributed F. E. Sanford and J. R. Oberholtzer, Commonwealth Associates, if line-type transformers and accessories for it had been economical at the time generating voltage began to increase. But converting existing 4 kv now costs as much as doubling its capacity. The economic advantage of 12 kv is primarily reduction in number of distribution substations. Savings are greatest where existing subtransmission can be used directly for distribution and for extensive new area developments.

Voltage above 4 kv has been used for distribution by Consumers Power since 1907, reported E. V. Sayles. Yet today only 20% of its circuits operate at 7.2 or 12.5 kv, and 60% are either 4.8 or 8.3 kv. His conclusion was that lower voltage circuits probably should not be converted but that a "middle-voltage" system of 34.5 to 69 kv should be superposed to provide for heavier loads.

Southern California Edison has concluded that 4-kv distribution can be expanded economically with larger components for existing 4-kv areas, said G. A. Davis. But new load areas should be served at 12 kv to avoid

(*More AIEE Meeting Report page* 36)

Here's an outstanding new development for RESIDENTIAL AREA LIGHTING

L-M's New Open Type Luminaire For Small Mercury or Incandescent Lamps

This completely new development in luminaires offers these advantages:

1. Pleasing appearance for residential areas.

2. Specially designed for the new 100 watt (3300 lumen) and 175 watt (6800 lumen) mercury vapor lamps.

3. Also efficiently handles incandescent lamps up through 6000 lumens.

4. Holophane® refractor glassware will provide type II 4-way offset, standard type II, type I, and type III patterns.

5. Open glassware provides for excellent cooling, larger lamps, easy re-lamping.

6. Alzak aluminum reflector, latched for direct attachment to Standard NEMA head.

7. L-M's V-band attachment provides easy replacement of glassware.

8. Modestly priced, but because of its design the luminaire handles much larger lamps than other luminaires at this price.

Ask the L-M Field Engineer for information on features, design, and delivery of the several types. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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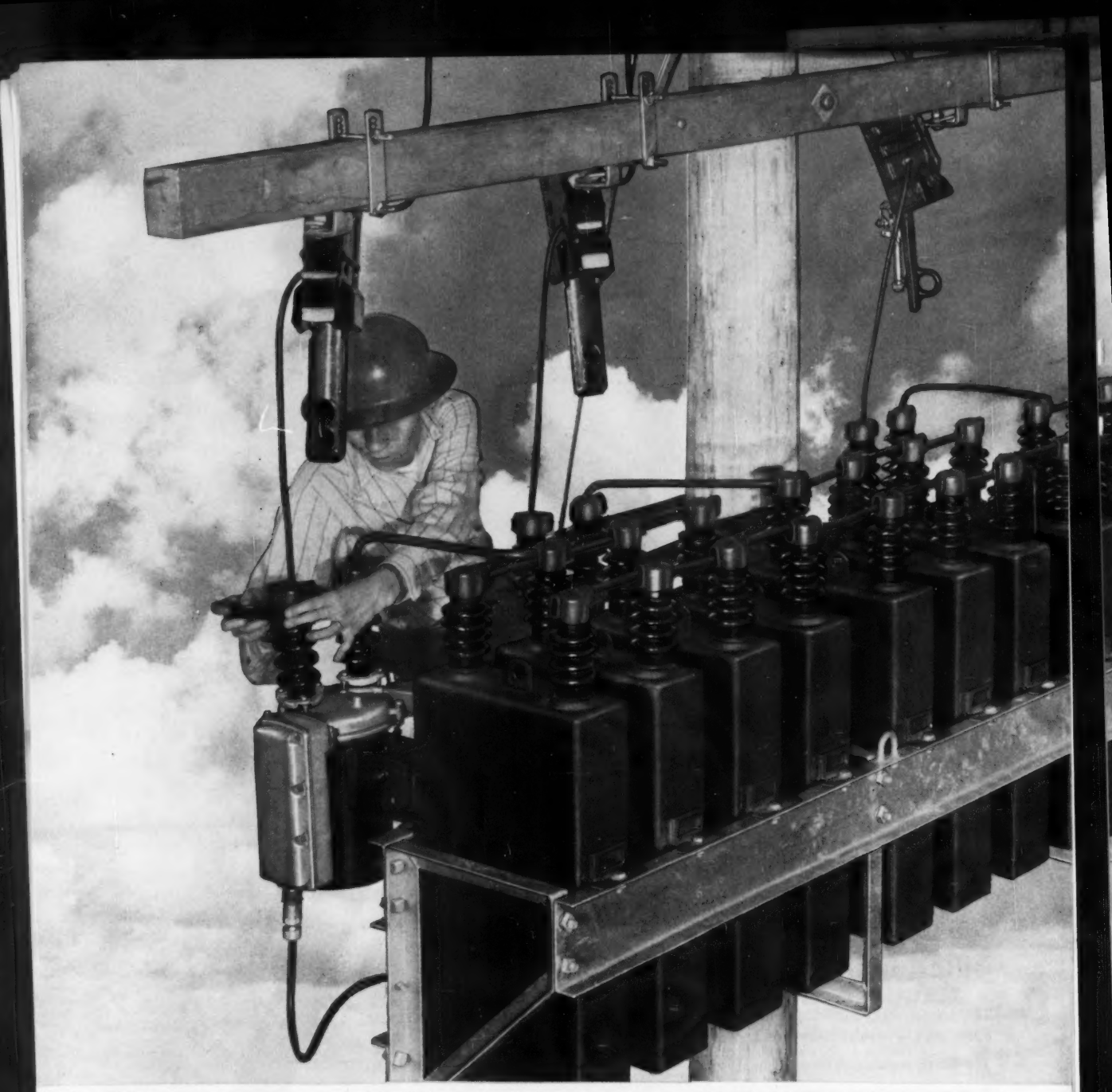
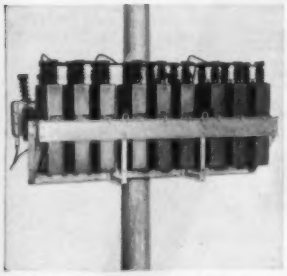
LINE MATERIAL

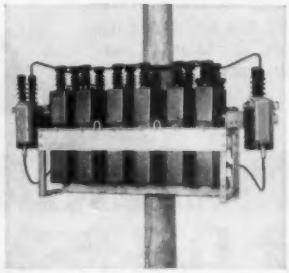
Street Lighting



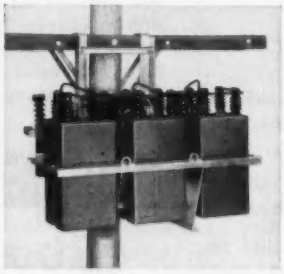
L-M's new 50 kvar capacitors are now available in 600 kvar switched capacitor racks. Assembly weighs only 43% more than a 300 kvar rack. Capacitor unit has same width, same thickness as a 25 kvar capacitor and will fit into existing NEMA standard hangers and L-M single-row racks.



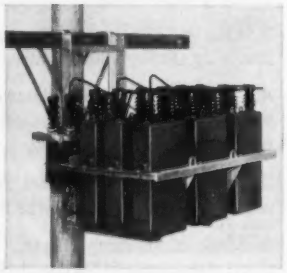
450 kvar single-row switched capacitor rack with L-M's Elemex 50 kvar capacitors. Weighs only 12% more than a 300 kvar single-row rack with 25 kvar capacitors.



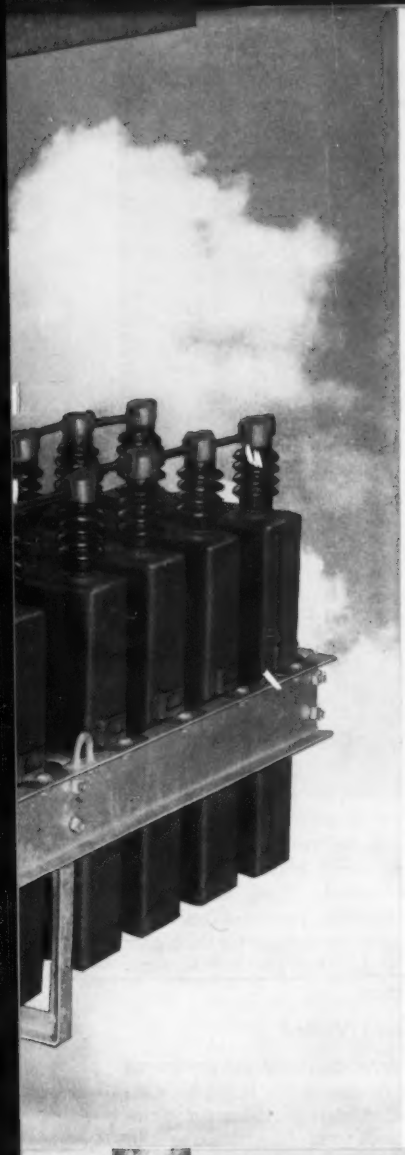
300 kvar single-row switched capacitor rack with L-M's Elemex 50 kvar capacitors. Assembly is quick and easy to install, inspect, and maintain.



300 kvar multi-row switched capacitor rack with L-M's 50 kvar capacitors. Switched racks are supplied with dependable L-M Kyle type NR oil switches.



450 kvar, 2400 volt multi-row switched capacitor rack with L-M's 50 kvar capacitors. Weighs only 150 pounds more than a 300 kvar rack with 25 kvar capacitors.



L-M's New 50 KVAR Capacitors Provide Greater Capacity Per Pole

Offer less weight and less pole space per KVAR

By **N. K. DELANEY**
Product Manager
Capacitors and Regulators
Line Material Company

Now you can hang capacitor racks of larger capacity on a pole with L-M's new 50 kvar Elemex® capacitors. Racks are factory-assembled and wired, shipped ready to install on distribution systems rated 2400 to 13,800 volts, multi-grounded wye. Bank sizes may be up to 450 kvar switched, 600 kvar unswitched multi-row racks, and up to 600 kvar switched or unswitched single-row racks.

Less Weight per KVAR

Line Material's new 50 kvar, 2400 volt capacitor weighs 109 pounds compared to 68 pounds for a 25 kvar unit. A 600 kvar, 2400 volt unswitched multi-row rack weighs only 51% more than a 300 kvar rack, and a 600 kvar, 2400 volt switched single-row rack weighs only 43% more than a 300 kvar rack.

Less Space per KVAR

L-M's new 50 kvar unit has the same width, same thickness as a 25 kvar capacitor and only 10 inches of additional height. It fits into existing NEMA standard hangers and into L-M's present single-row rack. Capacity of a single-row rack can be *doubled* with L-M's 50 kvar capacitors. A 450 kvar single-row switched rack with 50 kvar capacitors is approximately 2 feet narrower than a 300 kvar rack with 25 kvar capacitors. Handling, installation and maintenance costs per kvar have all been reduced with L-M's new 50 kvar unit.

Other Features of L-M's Elemex Capacitors and Capacitor Rack Assemblies

Elemex capacitors are individually dried and completely impregnated under vacuum with low-temperature Elemex liquid dielectric.

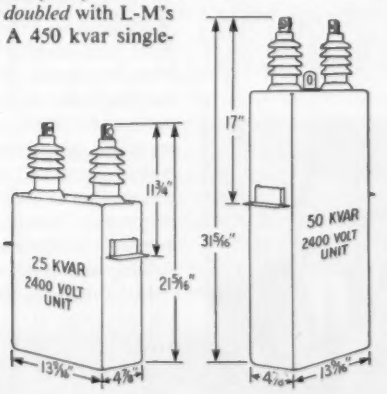
Unit has strong solder-sealed bushings of one-piece wet-process porcelain, "Paragroove" clamp-type connectors, and aluminum metallic coating under alkyd resin paint.

Assemblies have only one plug-in connection point per phase for control wiring, and one terminal box for all three phases.

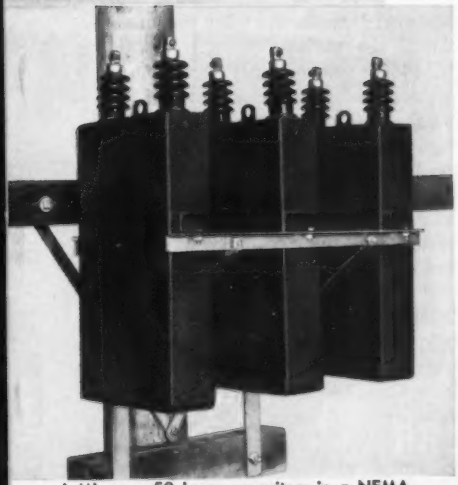
Assemblies are of complete bird-proof construction; terminals have neoprene rubber caps, plus 5 kv insulated conductor for high-voltage connections.

Get Complete Information

Ask the L-M Field Engineer for information on features, design, and delivery on the new 50 kvar Elemex capacitors and capacitor equipments. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



Only 10 inches of additional height gives twice the capacity.



L-M's new 50 kvar capacitors in a NEMA standard hanger. The capacitor has the same width, same thickness as 25 kvar capacitor and 10 inches of additional height. The three units provide 150 kvar—50% more than four 25 kvar units.

LINE MATERIAL

Elemex® Capacitors

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Distribution Voltage Battle Continues

(*Continued from page* 32)

costly 4-kv substations. Cutover from 4 to 12 kv cannot be justified unless rebuilding becomes necessary, but pole lines should be built for eventual cutover. The size of component has more bearing on cost than distribution voltage, he said.

Companies which have used higher voltage primaries find gains in flexibility and expansion ease, countered W. R. Bullard, Ebasco Services. Individual loads which might require substations for service at 4 kv are frequently picked up without distress on 12 kv. Flicker of primary voltage is rare, and growth can be supplied by incremental additions to large substations without pole congestion. Service reliability is attained by coordinated modern methods of clearing faults.

Widespread immediate changeover is not desirable, added Bullard. It is better to start at the fringes, halting expansion of lower voltage.

13-Kv Conversion Successful

This practice, begun by diverting subtransmission to distribution in 1946, has now placed 35% of the Long Island Lighting system on 13.2 kv, reported A. J. Pansini. Operating experience has been excellent, despite severe sleet storms and several hurricanes. But tree trimming must be more carefully maintained than for 4 kv.

Successful use of 14.4/24.9 kv for rural distribution was reported by L. B. Crann and V. M. Edmunds, REA. Operating difficulties have been overcome to the point where 24.9-kv service compares favorably with 7.2/12.5 kv. Major advantage of the higher voltage is increase in line capability, but transformer cost makes it uneconomical where installations exceed 2 per mi.

D. K. BLAKE, General Electric; W. R. Bullard, Ebasco Services

Discussion of this group of papers was lengthy and varied. D. K. Blake, GE, noted that 4 kv has proved suitable but that most companies make good use of 12 kv where rapid growth and well-set plans minimize changeover costs.

Disagreements Revealed

But many discussers took issue with Boston Edison's decision to retain 4 kv. P. M. Shelton, Narragansett Electric, observed that his company justified conversion of 100 mi to 12 kv which has operated successfully for 2 years. W. G. McKay, Ebasco, felt the Boston area should be favorable for conversion, surmised that the "crash" program had boosted its cost unfairly. Others questioned Weed's evaluation of losses and choice of aerial cable. A St. Louis engineer conceded that converting 4 kv may be undesirable in high density areas, but asked whether service reliability would be permitted to justify 4 kv where 12 kv offered real economy.

Others rallied to Weed's support. G. S. Van Antwerp observed that Philadelphia Electric has not been able to provide as good service with 13 kv as with 2.3 and 4 kv. And R. G. Hooke, Public Service E&G, called the problem one of fundamental planning in which evaluation of present worth of expenditures heavily discounts future savings.

Residential Aspects

The battle of voltages then moved to the residential service area with R. F. Lawrence and S. B. Griscom, Westinghouse, urging utilities to determine now whether a new distribution plan is needed. Factors to consider include ability to serve mass-produced appliances with motors to 15 hp and to serve electric home heating economically. They said that 3-phase 4-wire distribution at about 265/460 v would prove most economical, even with individual autotransformers to serve lighting and small appliances.

Lawrence also presented a companion paper by R. A. Zimmerman and H. E. Lokay, of Westinghouse, which compared distribution costs at 120/240-v 1 phase, 120/208-v 3 phase, 240/480-v 1 phase, and 265/460-v. 3 phase. Conclusions were that the 265/460-v system, transforming directly from 34.5-kv subtransmission, would give lowest cost per house when peak diversified demand per house exceeds 1.6 kva. Savings are so great at somewhat heavier loading that buried underground construction can be provided cheaper than conventional 120/240-v overhead.

An alternative proposal offered individual primary service units integrated into each house and served by buried primary cable to overcome today's overhead distribution problems. A. M. Lockie and H. B. Thacker, Westinghouse, explored the economics of the system for load densities of 1.6 to 10 kva per house but found it more costly than conventional overhead distribution.

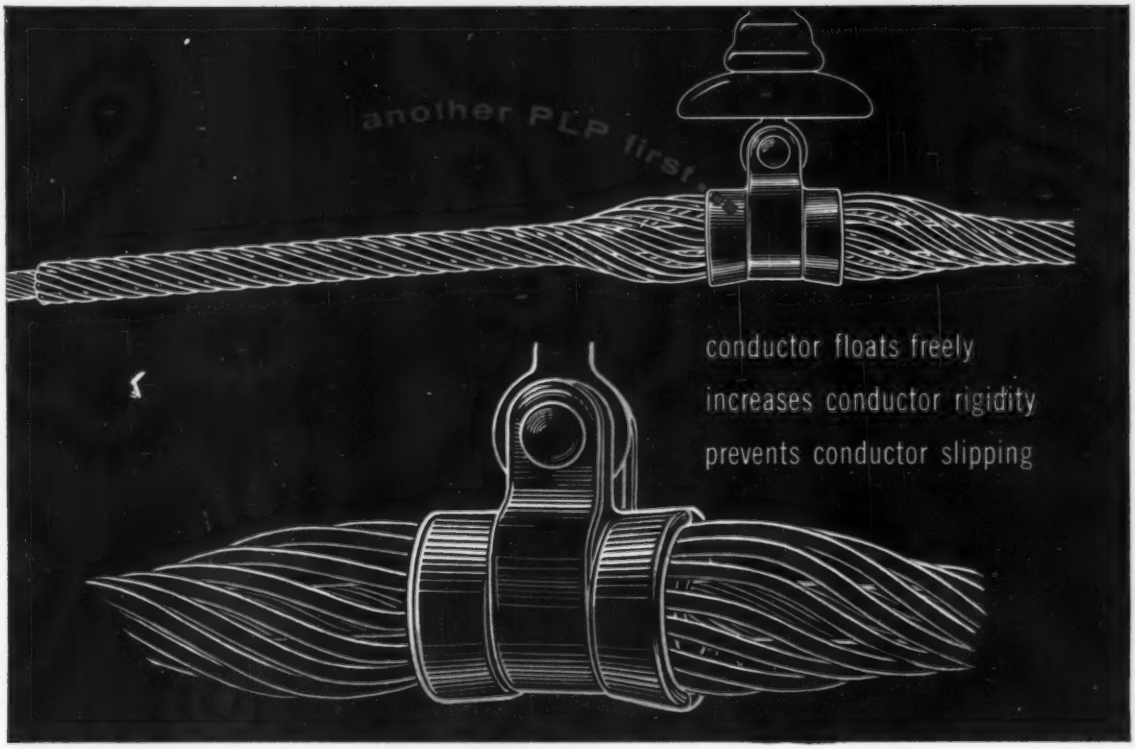
Support for 265/460

Support for the 265/460-v proposal came from P. G. Wallace, Texas P&L, who anticipates "considerable" economy in higher voltage, particularly where it is possible to re-use existing transformers. Customer objection to higher voltage on portable appliances he hopes will diminish with time, but autotransformers give a convenient transition. W. H. Johnson, American G&E, would prefer 1-phase, doubts that savings will reach 30%, and finds autotransformers objectionable unless customer-owned. Chase Hutchinson, Ebasco Services, predicted better resistance to storm damage for the higher voltage system but objected to autotransformers.

Objections Voiced

Less favorable were the comments of other discussers. D. K. Blake, GE, commended the provision of autotransformers to save costly changes in customers' appliances. But he questioned the savings claimed for the 265/460-v system, partly because they neglect losses and meter costs. H. C. Bingham, Cleveland Illuminating, felt that sites would be difficult to find for the large number of small substations. Both A. H. Kidder, Philadelphia Electric, and H. E. Campbell, GE, suspected that the conventional system had been penalized by too strict limitation of motor starting current. The latter also surmised that Code interpretations might demand a 3.6-kw autotransformer. And H. A. Enos, American G&E, doubted that the higher voltage would prove economical for small residential developments on most systems.

(*More AIEE Meeting Report page* 39)



an entirely new concept in suspension design

After five years of intensive laboratory research and field experience, Preformed Line Products Company announces the ARMOR-GRIP SUSPENSION. This is not just a modification of the conventional clamp—in fact, in a sense it is not a "clamp" at all. The ARMOR-GRIP SUSPENSION is a "floating suspension"—the conductor is cradled in neoprene and firmly gripped only by the custom-designed Preformed Armor Rods which distribute their pressure over a relatively large area. An ingenious relation between rods and housing prevents the suspension assembly from slipping longitudinally. The expanded configuration of the PLP rods also adds rigidity to the conductor while slight vertical resilience of the conductor mounting eliminates a steep stress gradient.

THE ARMOR-GRIP SUSPENSION ELIMINATES CONCENTRATED CLAMPING STRESSES.

In severe accelerated vibration tests, conductor mounted in the PLP ARMOR-GRIP SUSPENSION outlasts conventional clamp assemblies many times—in fact, no conductor failures have ever occurred under the ARMOR-GRIP SUSPENSIONS in these tests. Thousands of ARMOR-GRIP SUSPENSIONS have been installed during the past four years—with NO reported case of unsatisfactory performance.

Yet with all these functional advantages, the ARMOR-GRIP SUSPENSION is very easy to install. Simplicity of design has eliminated many parts—there are less than one-half the number contained in a conventional clamp assembly. Only one nut to tighten.

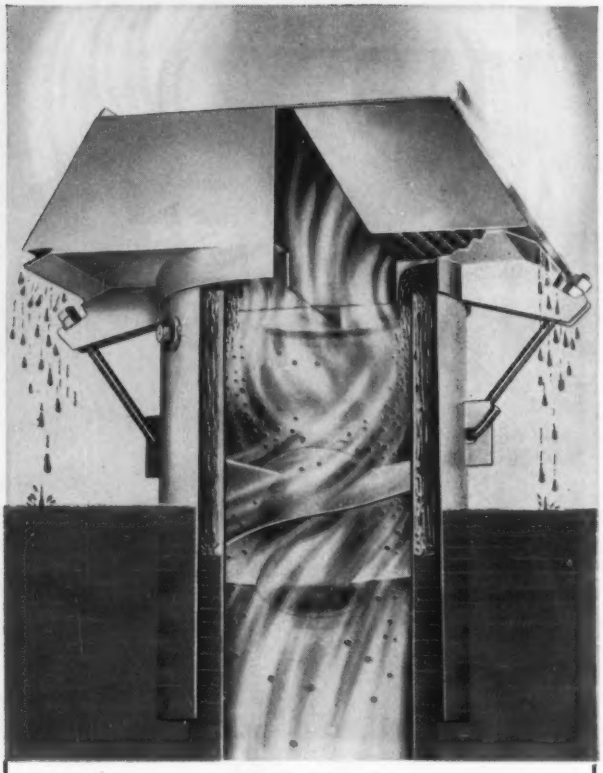
The ARMOR-GRIP is immediately available in conductor sizes in the ranges of 336,400 cm, 477,000 cm, 795,000 cm, 954,000 cm ACSR and All-Aluminum. Other sizes will soon be available and can be produced on request.

Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

PREFORMED LINE PRODUCTS COMPANY
5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO
TELEPHONE: CLEVELAND EXPRESS 1-3571

the C-E TURBO-SEPARATOR...

another reason for the high availability of turbines served by C-E Boilers



Clean steam is a most important factor in turbine performance. And clean steam demands effective drum internals.

The true test of any system of drum internals lies in what it can do with the combination of water, steam and solids it must handle – not alone under steady base load conditions – but under all operating conditions.

Whether the concentration of solids in boiler water averages less than 100 ppm or even more than 1000 ppm – or whether it fluctuates anywhere between – the C-E Turbo-Separator maintains steam purity and quality well within satisfactory limits.

To be more specific – test results in a number of cases have shown less than .5 ppm and in some instances as low as .1 ppm. These results are supported by the fact that in no plant where Turbo-Separators are installed has there been any measurable loss of turbine capacity due to deposits on turbine blades.

When you add the proven advantages of C-E Turbo-Separators to the operating characteristics of modern designs of C-E Utility Boilers, you have the right combination for top year-round plant performance on all counts – efficiency, capacity and continuity of service. B-904

HOW IT WORKS

Steam-water mixture enters the top of the boiler drum through nozzles discharging into an annular space formed by internal baffles. Flow of the mixture is directed downward behind symmetrical baffles around the entire drum surface, maintaining a uniform drum-wall temperature, and then into the Turbo-Separators which are arranged in parallel rows throughout the length of the drum. They contain a center core and vanes which give the mixture a spinning or centrifugal motion, thereby throwing the water to the outer edges of the inner tube. Directly above the directional vanes and cores there is a skim-off lip which directs the water over the top of the inner tube and thence through the annular space to the drum. This is the primary separation stage. The relatively dry steam then passes through two opposed banks of closely spaced corrugated plates, which change the direction of the steam many times and throw out much of the remaining water. This is the secondary separation stage. The third and final stage of purification is accomplished in the screen dryer.

C-E

COMBUSTION ENGINEERING

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

steam generating units; nuclear reactors; paper mill equipment; pulverizers; flash drying systems; pressure vessels; home heating and cooling units; domestic water heaters; soil pipe

Explore Industrial Distribution

A primary system voltage of 2,400, 4,160, or 4,800 is generally the most economical to serve 150 to 350-hp air conditioning motor drives in a large commercial building, according to D. I. Johnson and Donald Beeman GI.

When primary supply voltage is in the 15-kv class, motor sizes necessitate transformation below 5 kv, and both 480 and 2,400 v are economical. When all substation capacity is at not more than three locations, an all-480-v distribution system is less expensive.

Secondary substations are most economically placed about ten floors apart when secondary voltage is 120/208, and maximum length of 208-v riser should not exceed about five floors. When primary voltage is not above 5 kv, a system of light-duty substations, 150 to 300 kva, each with 120/208-v secondaries for lighting, may be economically attractive.

Provide for Load Growth

The molded-case, hydraulic-magnetic circuit breaker's minimum trip setting and instantaneous trip point are not affected by ambient temperature, according to J. B. Clapp, Heineman Electric, who collaborated with N. J. Schwartz. The hydraulic-magnetic breaker has, in effect, a 20% reserve for future load requirements.

More than $1,500,000 in equipment was saved through installation of a 480/277-v electrical distribution system in New York City's Coliseum, according to Howard D. Kurt. He and Lawrence E. Fisher, both of GE, described the installation.

Service consists of four 3,500-amp stubs supplied by a 480/277-v spot network in which are six 2,000-kva transformers. The stubs and main switchboard are connected by current-limiting busways of taped copper (or aluminum) bus bars, with wide phase spacing for high reactance. Current-limiting busway provides reactance values 8 to 23 times those of standard busways.

Silver-Sand Fuses Used

The 40-ft switchboard has four 5,000-amp main air circuit breakers having an interrupting rating of 100,000 amp rms asymetrical, one for each run of current-limiting busway. Four sets of 5,000-amp current transformers are in the switchboard for the Con Edison meters, and a second set for metering and relaying. Breakers are in cascade.

Electrical designers have today the means of controlling trouble on new commercial building distribution systems at voltages near 265/460 v, said W. Deans of I-T-E Circuit Breaker; who collaborated with J. DeLellis and A. J. Bisson, Consolidated Edison.

Available short-circuit current of 140,000 amp can be reduced to 100,000 amp by a high-impedance bus with a standard breaker. To obviate use of an unreasonably large interrupting-duty breaker at a riser distribution center, standard low-voltage breakers may be placed in cascade with it. Use of smaller rated conjunctional protective devices is practicable with silver-sand fuses.

An operator should safely switch "open" a protective and switching device in an industrial plant or commercial building circuit immediately after closing it against any duty not exceeding its short-circuit rating, said W. C. Huening Jr, GE.

Circuit breakers have overload protective characteristics that can be matched closely to circuit requirements. They have no parts to be replaced and their protective characteristics are unchanged after automatic protective operation. Single-phasing does not occur. But they are without current-limiting ability.

Combinations Cited

Interrupter switches on the other hand can be equipped with fuses which limit high available short-circuit current and provide low-current ratings with high interrupting ratings. But it's not always easy to obtain close overload protection, Huening said.

In a fuse-circuit breaker combination however, the breaker's trip characteristics make overload protection easy, he said. Fuses don't blow and are undisturbed for overloads and some limited short circuits.

Modern Materials Combat Corrosion

Corrosion prevention on pole lines also come in for scrutiny by AIEE. Locations near the seacoast or certain industrial operations cause severe deterioration of conductors and pole-line equipment, said A. S. Hadfield, Virginia E&P Co. ACSR 100 ft from the ocean, he said, suffered rusting of the steel core and serious oxidation of the aluminum.

Similar deterioration of galvanized steel hardware has been overcome by adoption of malleable iron and alloyed steel, coated with neoprene paint, he continued. Transformers stand up best with porcelain finish on the tanks, and lightning arresters must be sealed to exclude the atmosphere. Bushings and insulators require unusual precautions to guard against flashover.

Demand for high-strength low-alloy steel has far exceeded that for other corrosion-resistant materials like stainless steel or silicon bronze, reported L. P. Schmitt, Joslyn Co, in a paper prepared jointly with D. H. Fletcher, and D. B. Hamister.

Distribution equipment must be designed so that moderate corrosion does not seriously hamper its operation or life, added R. H. Amundson, Line Material. Large clearances and use of material which does not form bulky or gritty corrosion products helps on cutouts. Corona must be avoided because it attacks insulation as well as metal.

Certain alloys of aluminum show superior resistance to atmospheric corrosion, contended J. L. Eberly, Hubbard & Co. Performance is good in seacoast, heavy industrial, and chemical contaminations, as well as locations where wind-blown particles erode protective material.

Corrosion poses a particularly difficult problem for insulator hardware. Suspension insulators commonly have pins of carbon steel which lose strength by corrosion near the cement line. When voltage stress is maintained, this attack sometimes continues under the cement to crack the porcelain. Low-alloy steel has given little improvement, said J. M. Sheadel, Ohio Brass, in a paper with A. W. Bardeen, but enlarging the shank near the cement line helps to overcome loss of strength.

DISTRIBUTION TRANSFORMERS

THESE BRACELETS

COULD SAVE YOU...$210

Estimate your possible savings in terms of all transformers on your lines

Sometimes an ordinary transformer cover warps from uneven pressure because of careless tightening of clamps or bolts. If the cover has the usual cork or cork-and-rubber gasket, air can leak in. In one recent case-history moisture accumulated in the tank in less than a year, causing a short [circuit between tank and windings. The failure cost $210 for the service trip and replacement of the 5-kva, 2400-volt unit.

G-E cover design prevents this problem. The one-piece stainless-steel clamping band and Nitrile rubber gasket on a G-E transformer maintain a tight seal for the life of the transformer. The band is tightened with only one bolt—pressure is thus uniform around the rim. The gasket resists air and oil, and continues to exert "back" pressure against rim and cover. Similar one-piece stainless-steel bands and Nitrile gaskets are used for bushings and hand hole covers. Factory sealing is thus maintained permanently.

Gaskets and bands are easy to remove. The Nitrile gaskets, furthermore, require no cement and can be used over and over again.

Look at the other money-saving features that prove "All Transformers Are Not Alike": **Impulse testing,** for instance, saves years of transformer life. **AL/CU terminals** are designed to prevent both copper and aluminum conductors from loosening. **Strenicor terminal clamps** save terminals from breaking. **Super Melaglyp paint** saves up to two repaintings. **Nationwide warehouses** save utilities heavy inventory expense. **Service shops** can cut your repair and rebuilding costs.

For the complete story, contact your nearest G-E Apparatus Sales Office or G-E Agent—or write to General Electric Company, Section 431-35, Schenectady 5, N. Y.

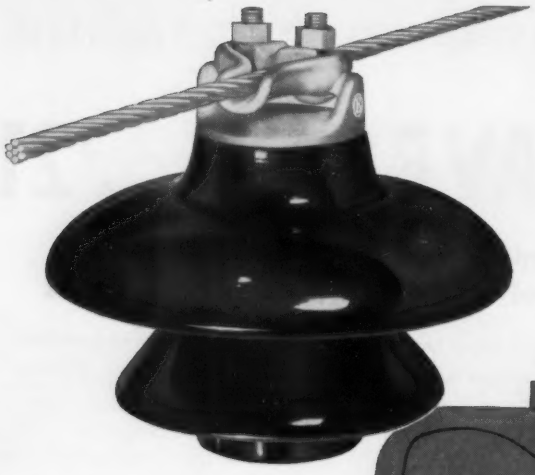
dollar-saving features prove ATANA*

*ALL TRANSFORMERS ARE NOT ALIKE
(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	√			√		√
Nitrile rubber gaskets	√					√
One-piece clamping band	√					
H-v and l-v terminals handle both copper and aluminum conductors	√					
Strenicor pressure terminal clamps	√					
Super Melaglyp paint	√					
More than 100 warehouses	√	√				
Nationwide, company-operated service shops	√	√				

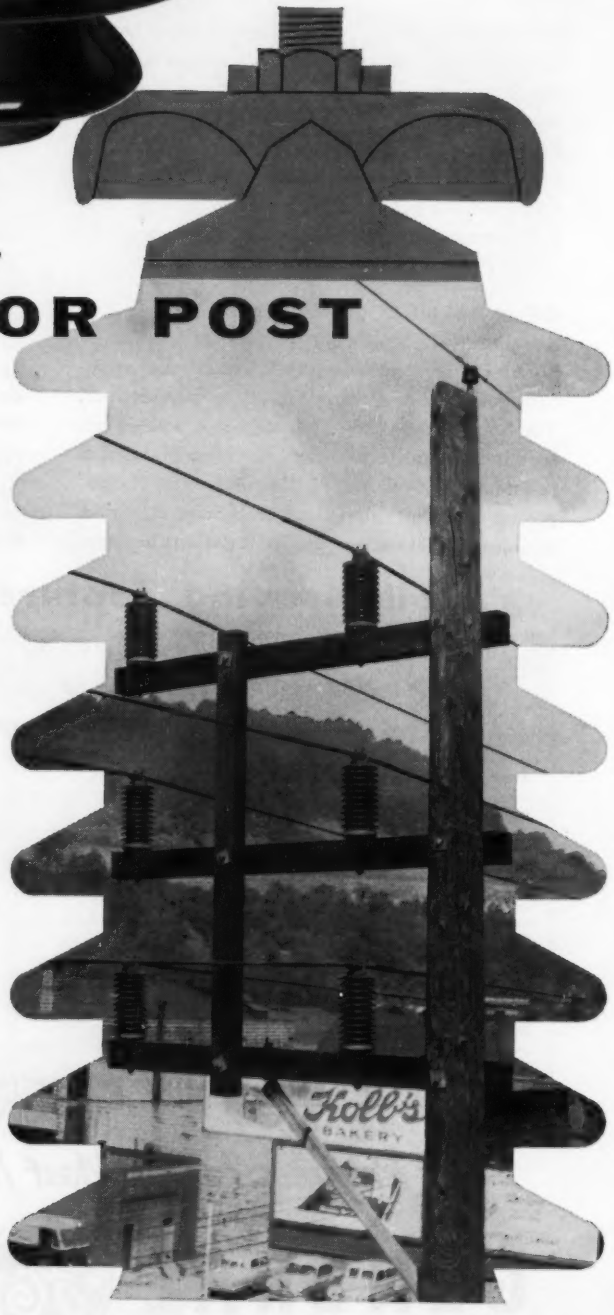
Progress Is Our Most Important Product

GENERAL ELECTRIC



Choose your Clamptop...

PINTYPE OR POST



O-B Makes Both Types; 18-Year Record Shows Steady Growth in Their Use

A choice between O-B Clamptop pintypes or Clamptop posts gives you the best available conductor grip AND the widest selection of mechanical and electrical characteristics! Ohio Brass Company makes both types of Clamtops, and the record proves that both are doing the job for which they were designed. For example: in 1938, 2528 Clamptops were in service; and in 1955, 412,927 units were in use. We're selling them at a faster rate every year.

Here's what Clamptops do for you:

1. Give secure conductor grip; avoid difficult tie wire work.
2. Eliminate radio disturbance.
3. Maintain even sag; prevent "sawing".
4. Add simplicity and safety to hot line work.

Don't let a limited range of M&E values, or a choice of only one insulator shape keep you from using Clamptops. Choose Pins OR Posts from the broad Ohio Brass selection!

Ohio Brass

MANSFIELD OHIO, U.S.A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4664-H

UP&L Names Chief Engineer

Utah Power & Light Co has announced the appointment of Harold Boehmer as chief engineer for the utility. He replaces T. A. Purton, chief engineer since 1943, who has retired.

In his new post Boehmer will be in charge of the design and construction of all the utility's installations. Boehmer, who received his mechanical engineering degrees from the University of Utah and California Institute of Technology, joined UP&L in 1934 and has held various positions with the utility, from draftsman to his most recent post as office engineer.

Upon retirement Purton joined Ebasco Services, Inc, to serve as an engineering consultant to a technical advisory group handling electric system installations in Greece.

H. BOEHMER

Childs Elected VP

S. J. CHILDS

Weston Electrical Instrument Corp, subsidiary of Daystrom, Inc, has elected Samuel J. Childs vice president and general manager, with responsibility for all manufacturing and production at Weston. He has been president of Daystrom Furniture Division since 1953.

Prior to assuming the latter post, Childs was president and treasurer of the Friend Manufacturing Co and of Bennett Manufacturing Co.

A graduate of Stevens Institute of Technology, Childs previously held various executive positions with De Laval Steam Turbine Co and later was executive vice president of American District Steam Co.

Anaconda Ups Harris

A. B. HARRIS

The Anaconda Co has announced the promotion of A. Baird Harris to director of purchases for the company.

Harris, who has held the position of purchasing agent since 1948, has been associated with Anaconda since 1945, when he joined the company as assistant purchasing agent.

Prior to World War II, Harris served as purchasing agent for International Business Machines Corp. His affiliations with IBM during the 1930's included service as European district sales manager at Geneva, Switzerland. He subsequently served as a special representative in charge of the Latin American territory.

50th Year Celebrated

Granville H. Bourne's Golden Anniversary of service in the public utility industry was feted this month. Chairman of the board of Commonwealth Services, Inc, Bourne completed 50 years of continuous service with the New York consulting and engineering firm and its predecessors in January. A group of utility and business leaders honored him with a dinner to mark the event.

Since his start in 1906 with Hodenpyl, Walbridge & Co, Bourne has held various posts with its successor firms. He became president of Commonwealth & Southern Corp in 1947, and in 1949 was named president of its successor, Commonwealth Services. His election as board chairman was in June 1955 when W. B. Tippy became president.

G. H. BOURNE

Edison Pioneers Elect Robins

Thomas Robins, right, was named incoming president of Edison Pioneers at recent 39th annual luncheon held in New York City.

With General Dynamics Corp Pres John Jay Hopkins, left, he studies a proclamation by New York City's Mayor Robert F. Wagner during a ceremony observing the 109th anniversary of the birth of Thomas A. Edison. Hopkins was guest of honor and speaker at the luncheon.

PERSONAL BRIEFS

American Gas & Electric Service Corp has named **Paul D. Martinka** contract engineer, effective Sept. 1. Formerly executive assistant in the general office of Ohio Power Co, an AG&E subsidiary, Martinka will transfer to the parent company's New York office March 1. In his forthcoming post, he will direct all special industrial power matters, particularly those touching on AGE Systems area development activities.

On March 1 three Virginia Electric & Power Co executive appointments will take place. **G. Fred Cook, Jr,** Portsmouth manager, will become director of public relations. He will be succeeded at Portsmouth by **P. W. Smith,** agricultural sales director. **W. R. Black,** agricultural engineer, has been appointed to replace Smith. The company's public relations director, **A. H. Herrmann,** a 46-year pioneer, will serve as consultant in the department.

Minnesota Mining & Manufacturing Co has appointed **Roy J. Gavin** as vice president and general manager of its Irvington Varnish & Insulator Division. Gavin, who has served as vice president of the division since 1953, succeeds retiring president **Arthur E. Jones** as Irvington's top executive.

Sylvania Electric Products, Inc, has designated **Lloyd Durfee, Jr,** as commercial lighting engineer. He previously was lighting engineer for Blackstone Valley Gas & Electric Co.

Hearn H. Lumpkin, area development representative of Georgia Power Co's Columbus Division, has transferred to the Atlanta Industrial Development Division.

Controls Corporation of America has named **Willis W. Mansfield** vice president and manufacturing director of its Soreng Division. And **Donald M. Strathearn, Jr,** has joined the division as vice president and director of engineering. Mansfield previously served as general factory manager for Penn Controls, and Strathearn was director of engineering for AVCO Manufacturing Corp's Bendix Home Appliance Division.

District manager reassignments of Pennsylvania Power & Light Co found **Kenneth S. Bittenbender,** head of the Wilkes-Barre district for the past six years, moved to Scranton in the same capacity. Lock Haven's manager, **Ray V. Hodgson,** replaces Bittenbender.

Charles A. Church has been appointed manager of communication for General Electric Co's engineering services. He is former manager of communications and community relations of the locomotive and car equipment department.

G. Dallas Rand has been appointed to the newly created post of manager of government relations of the Lighting Division of Sylvania Electric Products, Inc. Rand, previously sales manager of the Washington, D. C., district, will coordinate the activities of the various regional and district sales managers in the sale of lighting products to the government.

In recent reorganization of its electrical engineering department, Springfield (Ill.) City Water, Light, & Power Dept named **Lee Nickelson,** mechanical engineer, Lakeside Plant, as engineering assistant to **S. T. Anderson** general superintendent. **Anthony Massaro** was named assistant to superintendent and chief engineer, and Raleigh Cady became superintendent of operation and maintenance.

Malcolm R. Gilpin has become operations division chief of the Corps of Engineers' Southwestern Division, Dallas. Gilpin, former construction division chief, Alaska District, replaces **Roy G. McGlone** who retired.

New Duquesne Light Co rate department manager is **Victor E. Hill,** former assistant planning engineer, engineering and construction department. Hill succeeds **R. C. Grimstad** who becomes technical assistant to vice president, sales division.

OBITUARY

Clarence E. Yost, 74, retired treasurer of the Delaware Power & Light Co, died recently of a heart attack. Yost retired from DP&L eight years ago after having been associated with the utility and its affiliates for about 48 years.

Now...Wagner Form W Transformers are smaller, lighter in weight

Even before the newest trend to lighter, shorter transformers, Wagner's Form W construction resulted in small-size, lightweight distribution transformers.

Today, an improved new design makes possible a new Wagner Distribution Transformer of Form W design that is up to 17% lighter, 18% shorter, and requires less oil than any *previous* Wagner Pole Type Transformer.

For you, this means greater ease of handling, less storage space required. *It also means you can save money by putting greater transformer capacity on already existing structures.*

They offer you these proven features

1 SHUR-SEAL COVER

Wagner's exclusive Shur-Seal clamping ring keeps transformer sealed air-tight... no atmospheric moisture or dust particles can get inside—no loss of oil can occur at any time.

2 SAFETY-DESIGNED HV SIDEWALL BUSHING

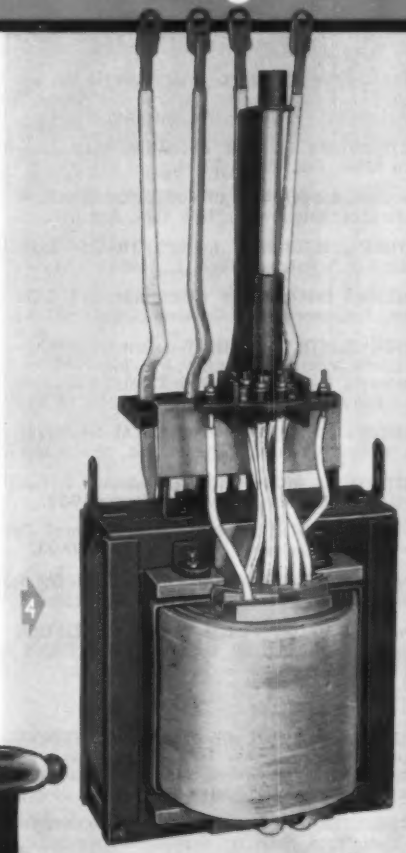
For use with either copper or aluminum conductor. Key-locked to prevent rotation. Conductor is simply pushed into connector and is tightened with a few turns of the insulated knob. Faster—easier—safer.

3 KEY LOCKED LOW VOLTAGE BUSHING

This bushing key-locks to prevent rotation... porcelain is keyed to the tank and metal stud is keyed to the porcelain. There can be no loose internal connections to cause shorts.

4 FORM W ELEMENTS

The new Form W core is of cold-rolled oriented grain transformer steel. Thermo-setting insulation bonds coil element into a solid, homogenous unit, which is braced to prevent any possibility of shifting.



These new Wagner Pole-type Distribution Transformers are available in ratings from 15 through 167 kva.

WAGNER ELECTRIC CORPORATION
6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

Wagner Electric Corporation
EST. 1891

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MEETINGS CALENDAR

FEBRUARY

AMERICAN MANAGEMENT ASSOCIATION—2nd Annual Electronics Conference & Exhibit, Hotel Commodore, New York, Feb. 27-29.

AMERICAN SOCIETY FOR TESTING MATERIALS—Committee Week, Hotel Statler, Buffalo, N. Y., Feb. 27-March 2.

MARCH

SOUTHERN SAFETY CONFERENCE, INC—Southern Safety Conference & Exposition, Hotel Biltmore, Atlanta, Ga., March 4-6.

* **INSTRUMENT SOCIETY OF AMERICA**—6th Annual Conference & Exhibit on Instrumentation for the Iron & Steel Industry, Hotel Webster Hall, Pittsburgh, Pa., March 5-7.

SOUTHEASTERN ELECTRIC EXCHANGE—23rd Annual Conference, Boca Raton, Fla., March 12-14.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—12th Annual Conference, Hotel Statler, New York, March 12-16.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Edgewater Beach Hotel, Chicago, Ill., March 12-16.

AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS—Fifth Annual Spring Conference, Hotel Cleveland, Cleveland, Ohio, March 15-16.

EDISON ELECTRIC INSTITUTE—Industrial Relations Committee, Muehlebach Hotel, Kansas City, Mo., March 15-16; Street Lighting Committee, Minneapolis, March 23-24; 22nd Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 26-29.

* **AMERICAN SOCIETY OF MECHANICAL ENGINEERS**—Spring Meeting, Multnomah Hotel, Portland, Ore., March 18-21.

INSTITUTE OF RADIO ENGINEERS—Annual National Convention, Waldorf-Astoria Hotel, New York, March 19-22.

* **OKLAHOMA UTILITIES ASSOCIATION**—Annual Convention, Biltmore Hotel, Oklahoma City, Okla., March 22-23.

* **PACIFIC COAST ELECTRICAL ASSOCIATION**—Engineering & Operating Section, Palace Sheraton Hotel, San Francisco, March 22-23.

TENNESSEE VALLEY PUBLIC POWER ASSOCIATION—10th Annual Meeting, Farragut Hotel, Knoxville, Tenn., March 30-31.

APRIL

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—South West District Meeting, Baker Hotel, Dallas, Tex., April 2-4; Great Lakes District, Fort Wayne, Ind., April 16-18; Technical Conference, Bradford Hotel, Boston, Mass., April 26-27.

INDIANA ELECTRIC ASSOCIATION—16th Annual Young Men's Utility Conference, Hotel Van Orman, Fort Wayne, Ind., April 4-5.

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

MARYLAND UTILITIES ASSOCIATION—Annual Business Conference, Lord Baltimore Hotel, Baltimore, Md., April 6.

MIDWEST RESEARCH INSTITUTE—Symposium for Management on Applications of Analog Computers, Hotel Phillips, Kansas City, Mo., April 10-11.

POINT OF PURCHASE ADVERTISING INSTITUTE—10th Annual Symposium & Exhibit, Hotel Sheraton Astor, N. Y., April 10-12.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Annual Membership Meeting, Ridpath Hotel, Spokane, Wash., April 11-13.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Engineering & Operation Section, Hotel Vancouver, Vancouver, B. C., April 11-13.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

EDISON ELECTRIC INSTITUTE—National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, New York, April 16-18; Industrial Relations Committee, EEI Headquarters, New York City, April 19; Engineering Committees, Edgewater Beach Hotel, Chicago, Ill., April 30-May 2.

GREATER NEW YORK SAFETY COUNCIL—26th Annual Safety Convention & Exposition, Hotel Statler, New York City, April 16-20.

ATOMIC INDUSTRIAL FORUM, INC—Atomic Energy Conference, Atlanta, Ga., & Oak Ridge, Tenn., April 17-19.

PACIFIC COAST ELECTRICAL ASSOCIATION—Administrative Services Section Meeting, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-19.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

CONFERENCE FOR PROTECTIVE RELAY ENGINEERS—Ninth Annual Conference, Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, April 23-25.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Conference on Recording & Controlling Instruments, Bradford Hotel, Boston, April 26-27.

MAY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Rochester, New York, May 2-4.

EDISON ELECTRICAL INSTITUTE—Accident Prevention Committee, Coronado Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8; Industrial Relations Committee, Willis E. Hughes Memorial, Rochester, N. Y., May 17.

NATIONAL FARM ELECTRIFICATION CONFERENCE—LaSalle Hotel, Chicago, Ill., May 3-4.

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

NORTHWEST PUBLIC POWER ASSOCIATION INC—Engineering & Operations Section, Cascadian Hotel, Wenatchee, Washington, May 10-11.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Design Engineers—Design Engineering Conference, Convention Hall, Philadelphia, Pa., May 14-17.

PENNSYLVANIA ELECTRIC ASSOCIATION—Relay and Electrical Equipment Committees, Hotel Roosevelt, Pittsburgh, May 17-18.

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC—Spring Meeting, The Homestead, Hot Springs, Va., May 20-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Development Section, Benjamin Franklin Hotel, Seattle, Wash., May 21-23.

* **AMERICAN MANAGEMENT ASSOCIATION**—General Management Conference, Hotel Roosevelt, New York City, May 23-25.

CIGRE—16th Annual International Conference, Paris, France, May 30-June 9.

JUNE

EDISON ELECTRIC INSTITUTE—24th Annual Convention, Traymore Hotel, Atlantic City, June 4-6.

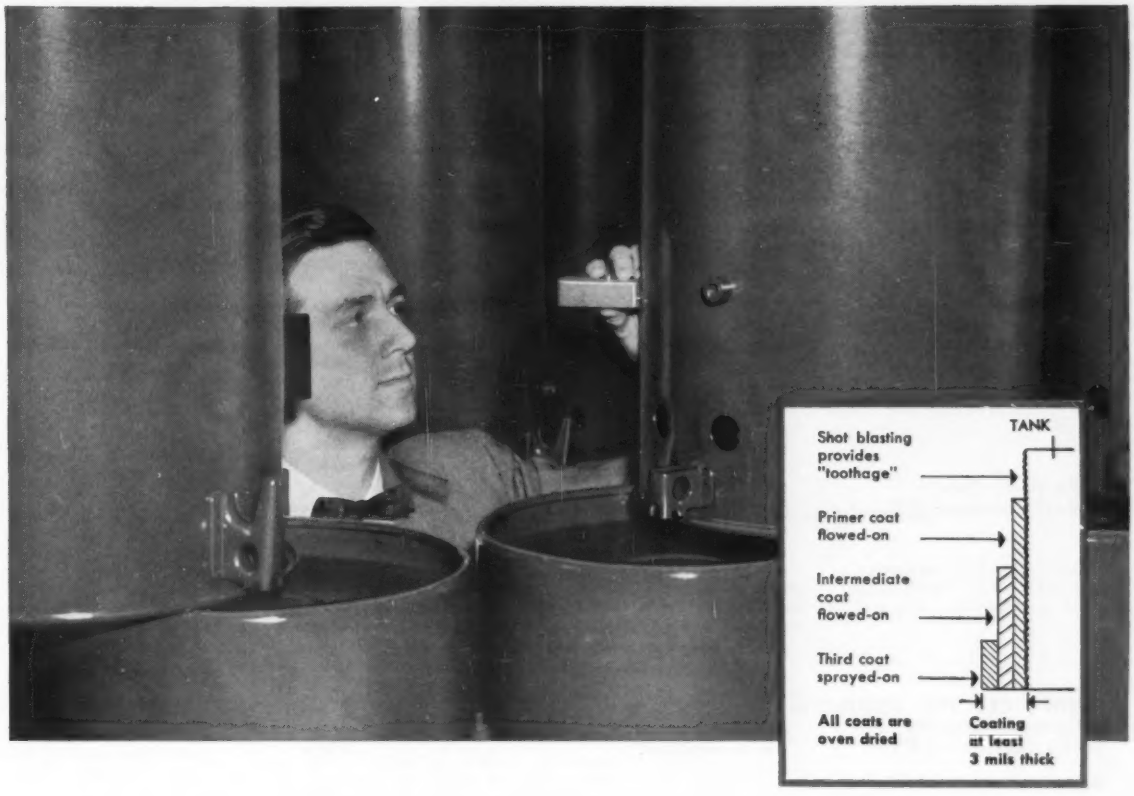
NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—48th Annual Convention, Ambassador & Chelsea Hotels, Atlantic City, N. J., June 11-14.

* **PENNSYLVANIA ELECTRIC ASSOCIATION**—Electrical & Relay Committees, Hotel William Penn, Pittsburgh, Pa., June 17-18.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Semi-annual meeting, Statler Hotel, Cleveland, Ohio, June 17-21.

* **AMERICAN SOCIETY OF TESTING MATERIALS**—59th Annual Meeting & 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J., June 17-22.

* Additions this week.



He's taking the "whether" out of weather...by checking paint thickness on POLE STAR tanks

For effective, long-term protection of transformer tanks during outdoor service, paint thickness of at least 3 mils (0.003 in.) is recommended by paint experts. Pennsylvania Transformer Company has set up a rigidly controlled triple-coat painting process which, in itself, insures that every Pole Star distribution transformer is given a high quality coating that satisfies this requirement. As a final check, however, tanks are tested with an Elcometer, a magnetic device for measuring the thickness of paint on metal — an "extra precaution" that typifies Pennsylvania's insistence upon the highest possible quality.

The paints used on Pole Stars have passed the severest weathering tests, both in the laboratory and in the field. Tank surfaces are thoroughly shot-blasted with steel grit to remove all scale, grease and dirt, and to provide "toothage" for the all-important primer coat. Paint viscosity — an important factor in coating thickness — is checked constantly. The primer and intermediate coats are applied by the flow method for heavy, uniform coverage, and the final coat is sprayed-on to insure a smooth finish with a maximum gloss. Each coat is oven-dried before the next coat is applied.

PENNSYLVANIA GRAY-SPRAY TOUCH-UP PAINT

in easy-to-use pressurized spray cans now is available at nominal cost. Keeping a small supply on hand will facilitate the minor touch-up jobs necessitated by surface damage during installation or other handling.

POLE STAR pt

167 Production Controls make POLE STARS best!

PENNSYLVANIA TRANSFORMER COMPANY

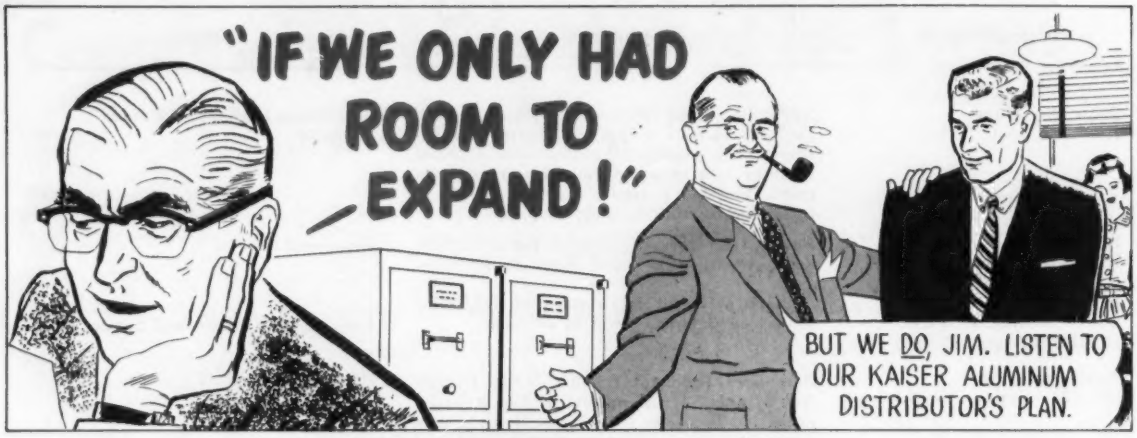
A McGraw Electric Company Division **CANONSBURG, PA.** *Greater Pittsburgh District*

Pole Star Transformers are available in all standard single phase distribution sizes from 3 through 500 kva, through 67,000 volts.

Congressional Scoreboard for Utilities

Identification	Explanation	Status
GOVERNMENT POWER AGENCIES:		
TVA Financing		
HR-6575 (Davis: D-Tenn.) HR-6576 (Jones: D-Ala.)	Permit issuance of 50-year bonds for new construction; bonds secured by power revenues; permit Treasury purchase of bonds. TVA endorsed.	Introduced in House
S-2373 (Kerr: D-Okla.)	Similar to above but no Treasury bond purchase.	Hearings held in Senate Subcommittee
HR-6770 (Buckley: D-N.Y.)	Budget Bureau's version, backed by Eisenhower; requires Budget Bureau and Congressional approval of use of bond proceeds; limits bonds outstanding to $750 million; no Treasury purchases; requires bond receipts and expenditures to be shown in national budget.	Introduced in House
TVA Power Sales		
HR-417 (Dondero: R-Mich.)	Ends TVA's control of local resale rates and sole supplier clause in TVA sales contracts.	Introduced in House
Missouri Valley Authority		
HR-2687 (Wier: D-Minn.)	Creates authority to draw up unified valley development plan; transfers Ft. Peck Dam to MVA; permits president to transfer others; authorizes power resale rate control.	Introduced in House
HYDRO ELECTRIC PROJECTS:		
Niagara Development S-1823 (Lehman: D-N.Y.)	Provides state development with federal preference provisions.	Approved by Senate Public Works Committee
S-6 (Capehart: R-Ind.)	Provides development by five private utilities under a license.	Rejected by Senate Public Works Committee
HR-5706 (Buckley: D-N.Y.)	Provides New York State Power Authority development under federal license with preference provisions.	Subcommittee hearings held
HR-5878 (Davidson: D-N.Y.) HR-8109 (Buckley: D-N.Y.)	Duplicate of Lehman bill for state development.	Subcommittee hearings held
HR-142 (Miller: R-N.Y.) HR-420 (Dondero: R-Mich.)	Provides development by five private utilities.	Subcommittee hearings held
HR-5377 (Radwan: R-N.Y.)	Provides Army Corps of Engineers construction leaving question of ownership and disposition of power to Congress.	Subcommittee hearings held
Hells Canyon		
S-1333 (Morse: D-Ore. and 29 others) HR-4719 (Pfost: D-Idaho) HR-4730 (Green: D-Ore.) HR-4739 (Magnuson: D-Wash.) HR-4740 (Metcalf: D-Mont.)	Authorize federal construction of single high dam with 800,000-kw; BPA to market power.	Subcommittee approval in both houses
Upper Colorado		
S-500 (Anderson: D-N.M. and nine others) HR-270 (Dawson: R-Utah) HR-2836 (Fernandez: D-N.M.) HR-3383 (Aspinall: R-Colo.) HR-4488 (Rogers: D-Colo.)	Bills differ, but all authorize a series of federal dams in the Upper Colorado River Basin for multi-purpose project development about 1-million kw.	S-500 passed by Senate HR-3383 approved by House Committee, awaiting debate
Fryingpan-Arkansas		
S-300 (Millikin: R-Colo.; Allott: R-Colo.) HR-412 (Chenoweth: R-Colo.)	Authorize federal construction of multi-purpose, 105,000-kw project on Roaring Fork and Fryingpan Rivers in Colorado; repayment in 60 years.	Both bills have been approved by committees
Narrows		
S-2251 (Welker: R-Idaho) HR-6620 (Budge: R-Idaho)	Authorize federal construction on Snake River of 180,000-kw project.	Introduced in House and Senate

Identification	Explanation	Status
John Day Dam HR-5789 (Coon: D-Ore.)	Authorize federal construction with six months for local interests to apply for partnership participation in paying $273-million cost of power facilities in return for long-term power contracts. Project on Columbia River, Oregon-Washington border, with 1,105,000-kw planned.	Brief House hearings held, more promised
Libby Dam HR-419 (Dondero: R-Mich.)	Rescinds federal authorization for 600,000-kw development on Kootenai River in Montana.	Introduced
Bridge Canyon Dam S-403 (Malone: R-Nev.) HR-3148 (Young: R-Nev.)	Authorizes federal construction of 750,000-kw project on Colorado River in Arizona.	Introduced in House and Senate
Tuolumne HR-2388 (Engle: D-Calif.)	Authorizes Tuolumne Country Water District No. 2 to build and operate 70,000-kw hydro project on Tuolumne River below Hetch Hetchy reservoir, with provision prohibiting sale or lease of power rights except to California public agencies.	House hearings held
Oroville HR-462 and HJ-Res-462 (Engle: D-Calif.)	Provides $100-million federal contribution to California which has been authorized to build this 465,000-kw project on Feather River as part of Central Valley Project.	Introduced in House
Cougar-Green Peter-White Bridge HR-4662 (Ellsworth: R-Ore.)	Provides for partnership construction of power facilities; City of Eugene, Ore., would finance 25,000-kw power at Cougar; private utilities would finance 82,000-kw total at Green Peter and White Bridge.	House public works subcommittee held hearings
Brazos River HR-2819 (Burleson: D-Tex.) HR-2873 (Poage: D-Tex.) S-2117 (Johnson: D-Tex. and Daniel: D-Tex.)	Authorize federal purchase of up to one third, but not over $50 million, of revenue bonds to be issued by Brazos River Authority to finance 500,000-kw multi-purpose project.	Introduced in Senate and House
OTHER LEGISLATION		
Holding Company Act HR-6294 (Dodd: R-Conn.) HR-7258 (Thompson: R-Mich.) HR-7554 (Hayworth: D-Mich.) S-2643 (Potter: R-Mich.)	Amend act of 1935 by removing technical provisions from act which are obstructions to companies' team-development of electric energy, particularly atomic power.	Introduced in House and Senate
Kwhr Tax HR-5694 (Mason: R-Ill.)	Levies 5% tax on sales price of manufactured articles, including "electricity, gas, steam, or other forms of energy."	Introduced in House
Labor Disputes S-527 (Holland: D-Fla. and Robertson: D-Va.)	Prevents federal laws from nullifying state laws prohibiting strikes in Utilities.	Introduced in Senate
S-794 (Curtis: R-Neb.)	Reserves to state authority to exercise jurisdiction over labor disputes involving utilities.	Introduced in Senate
Downstream Benefit Charges S-1574 (Goldwater: R-Ariz.)	Authorizes Interior to make annual payments for hydro power benefits received by downstream federal projects from upstream non-federal projects.	Subcommittee hearings held
REA Audit S-2230 (Williams: R-Del.) S-2466 (McCarthy: R-Wis.) HR-7343 (Church: R-Ill.)	Subjects REA to Government Corporations Control Act, extending Government Accounting Office audit authority over REA.	Introduced in House and Senate
Highway Relocation S-1048 (Gore: D-Tenn.)	Provision in highway bill for payment of half the costs of relocating utility facilities, limited to 2% of each state's allotment.	Passed by Senate
HR-8836 (Fallon: D-Md.)	Provision for reimbursing states when state funds have been used for utility reimbursement.	Hearings being held
Federal Atom Power S-1049 (Gore: D-Tenn. and Monroney: D-Okla.)	Authorize appropriation of money for experimental nuclear facilities to demonstrate practical value.	Introduced in Senate
S-2725 (Gore: D-Tenn.)	Directs AEC to build 6 plants of different design for same purpose.	Introduced in Senate



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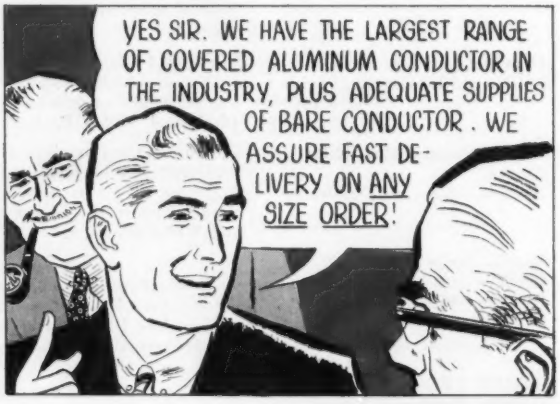
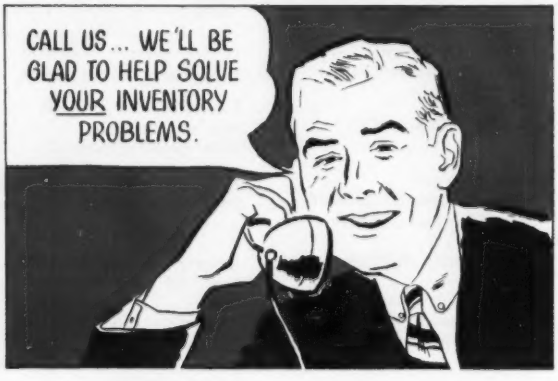
THAT'S FINE! BUT CAN YOU FILL ALL OUR ORDERS PROMPTLY?


YES SIR. WE HAVE THE LARGEST RANGE OF COVERED ALUMINUM CONDUCTOR IN THE INDUSTRY, PLUS ADEQUATE SUPPLIES OF BARE CONDUCTOR. WE ASSURE FAST DELIVERY ON ANY SIZE ORDER!

AND KAISER ALUMINUM'S FAMED ENGINEERING SERVICE IS ALSO AVAILABLE TO YOU.
SOUNDS LIKE THIS SOLVES OUR PROBLEM WE'LL GIVE IT A TRY.



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Fairmont Supply Co.
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Helder Electric Supply
Hampden Electric Supply Co.
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Temple, Inc.
United Electric Supply Co.
Vermont Hardware Co., Inc.
Virginia Electric, Inc.
George H. Wahn Co.
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GET IN TOUCH with your nearest Kaiser Aluminum Distributor *now!* Refer to the list at the left and your local telephone directory. Kaiser Aluminum and Chemical Sales, Inc., *General Sales Office,* Palmolive Bldg., Chicago 11, Ill.; *Executive Office,* Kaiser Bldg., Oakland 12, Calif.

Kaiser Aluminum

THE NATION'S LARGEST SUPPLIER OF ALUMINUM WEATHERPROOF CONDUCTOR AND TRIPLEX

Trade Help Looks Promising

Utilities report high audience response at LBE closed circuit shows; prospects appear bright for all-industry support

Response to "Live Better . . . Electrically" by utilities and their local trade allies appears to be hypoed following the Feb. 8 LBE closed circuit television show. Final count reveals some 40,000 electrical, financial, construction and real estate people saw the show.

Admittedly, it is too early yet to tell definitely what positive action these business allies will take once the verbal acknowledgments are over. But a spot check of utilities across the country showed encouraging signs. One group of eastern contractors plans to use "Live Better . . . Electrically" as the theme of its annual convention next summer. A New England builder publicly urged colleagues at the show he attended to tie-in with LBE demonstration homes. And demands for kinescopes indicate that an additional quarter-million will see the show in coming weeks. Even Sears Roebuck & Co is considering LBE tie-ins and Indianapolis Power & Light Co has an electric home promotion in the mill with local builders. Other developments:

• Consolidated Edison Co of New York, Inc will identify LBE with its present wiring program (EW, Jan. 16, p 31). Wesley Meytrott, assistant vice president, said he is getting "a flock of letters," although nothing definite has developed from them yet. "But," he says, "aside from direct promotional support, it's a favorable state-of-mind on the part of builders and architects that we hope to create."

• Western Massachusetts Electric Co has staged follow-up meetings on wiring with contractors and has appointed a full-time man to handle trade liason work.

• Detroit Edison Co will set up two complete road shows, using the closed circuit kinescopes, to take to trade audiences in its area.

• In Atlanta, Georgia Power Co said reaction to the show was "very, very good", but expressed some concern over little interest shown by lending agencies.

• "We expect fine cooperation from local people," said Utah Power & Light Co's W. A. Huckins. "This will be easy to develop because we have been working closely with them ever since we left merchandising."

• Pacific Gas & Electric Co's O. R. Doerr probably best summed up the problem utilities will have in rallying trade support. Said Doerr: "We have promise of as fine a cooperative job as we could expect. But we must keep up the momentum. Right now people are impressed, but we must spell out in detail what they can do to help."

AMARILLO, TEXAS: D. H. Buck, left, LBE representative, goes over promotional material with A. P. Coolidge and W. L. Pearson of Southwestern Public Service Co

SOMERVILLE, N. J.: 350 business people heard Pres C. E. Kohlhepp, New Jersey and Jersey Central Power & Light Cos, explain their stake in LBE at TV show

LBE CALENDAR

MONTH OF APRIL—Consumer advertising breaks . . . Spreads in nine national consumer magazines . . . Release of "Home Planners Guide" to utilities for customer distribution . . . "Meet Mrs. Swenson", 27½-min color-sound film ready for utility showing . . . 15 types of exhibit and display material ready for shipment.

APRIL 8—Judy Garland on kickoff television show, CBS network . . . similar network shows to follow monthly.

If you're building, modernizing, expanding

New Low Voltage Circuit Breakers Offer New Safety, Economy

It will pay you to learn about these breakers. Somewhere in every electrical system there are circuit breakers for protection of electrical supply — and prevention of damage to property.

For better protection than ever — greater safety — more convenience, get the All-New Allis-Chalmers low voltage circuit breaker.

It is the only breaker that tells the maintenance man which phase is faulted — thus saving labor and downtime. A small signal flag does the trick.

These breakers can be furnished as basic units, in individual boxes, or several can be placed together in attractive cabinets.

In boxes or cabinets, these breakers offer the ultimate in safety to your personnel. No live parts are exposed — even when the front door is opened for maintenance and inspection.

As a result of these advantages, the new low voltage circuit breakers have met with unusual acceptance in the short time they have been available.

Get Complete Information—or let us send Bulletin 18B8252 to your electrician, purchasing man, or plant engineer. Call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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A-C ALLIS-CHALMERS

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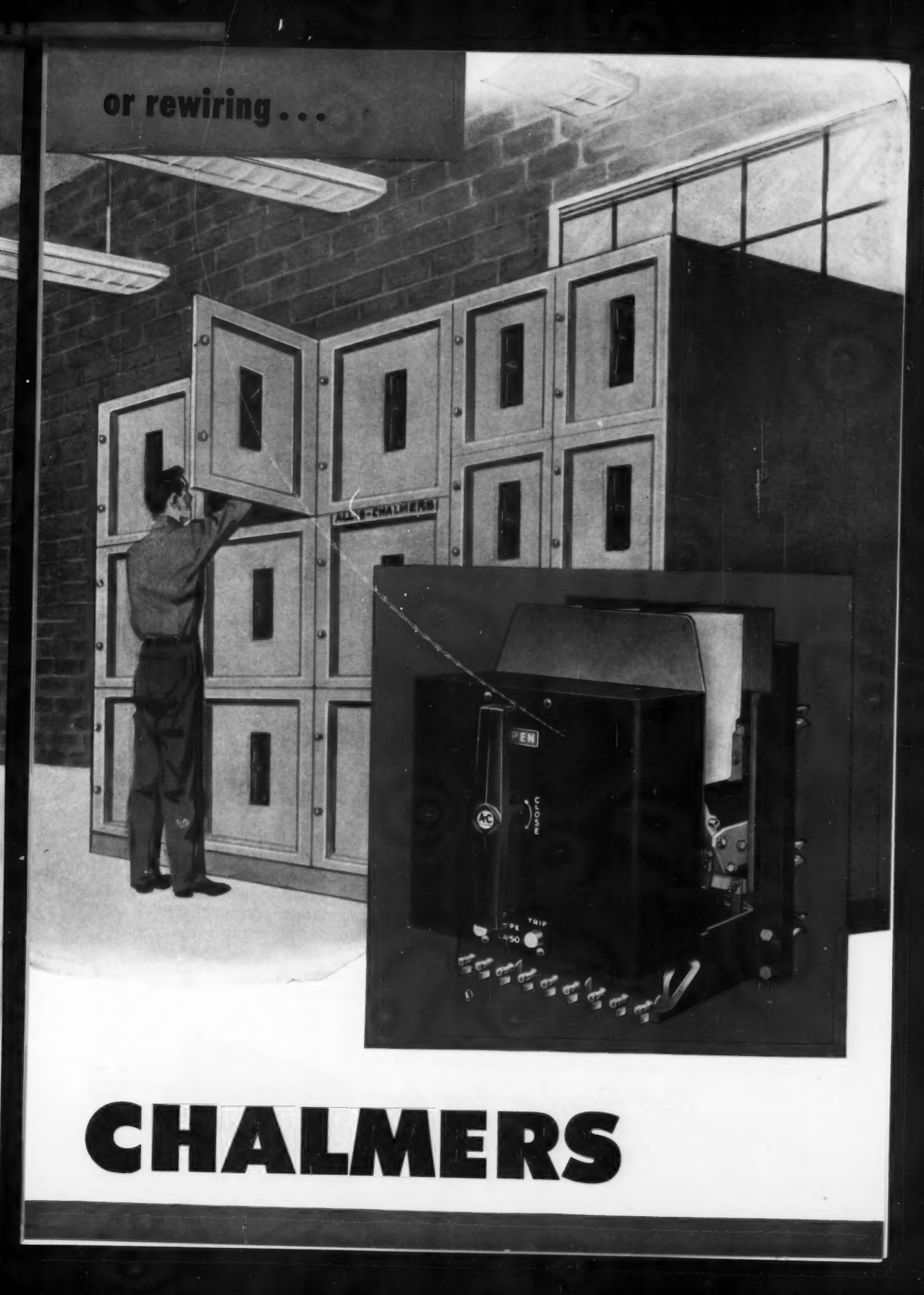
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ALLIS-CHALMERS
OPEN
CLOSE
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Rely on Graybar . . .
ESPECIALLY IN EMERGENCIES

Graybar's long experience in serving the everyday needs of utilities is especially valuable when lines go down.

A nation-wide network of Graybar offices and warehouses provide ready accessibility of pole-line supplies. You can depend on the fastest possible deliveries of emergency replacement items —wherever and whenever they are needed.

Experienced Graybar personnel have developed the know-how needed to initiate immediate action and efficient follow-through from working closely with utilities daily and through emergencies of all kinds.

Moreover, Graybar is totally owned by its operating and retired personnel. That's why you're sure to get, especially in emergencies, *personal* service from people who have a *personal* interest in giving you the assistance you need, when you need it. 619-92

Graybar Electric Company, Inc.
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Call Graybar first for...

IN OVER 130 PRINCIPAL CITIES

PA's Propose Pricing Principles

Purchasing agents attending the 25th annual conference of the National Association of Purchasing Agents public utility buyers' group expressed a grave concern over what they described as a lack of fairness in many of their suppliers current pricing policies. To assist manufacturers in establishing policies which buyers would consider more reasonably equitable four principles were offered (see memo at right).

Recognizing that there are two sides to every story, the utility buyers' group also heard representatives of three of their major suppliers discuss their companies' current pricing policies.

The meeting, held at Chicago on Feb. 5-7, has in the past acquired a reputation as a medium for the development of sound and desirable seller-buyer relationships.

Buyers Getting More Today

George H. Cole, manager of purchases for the Alabama Power Co, in expressing buyers' views on pricing, admitted that today utilities were receiving more for their money than ever before. However, he contended, although manufacturers agree that some practices in pricing should be changed, there has been little effort to reconcile differences and to put price adjustments and pricing on a more realistic basis.

Price-in-Effect Attacked

Price-in-effect at the time of shipment was characterized by Cole as the most vicious and the most abused of pricing practices. Other practices to which he objected were the application of latest and peak manufacturing costs to portions of the order completed at lower cost and, secondly, the shift in policies on heavy equipment escalation. In this he questioned whether or not there has been a shift on heavy equipment escalation from a position of protection against unforeseeable manufacturing cost increases to a use of escalation to substantially alter profit margins.

In discussing formula escalation, Cole did agree that, with some reservations, the formulas recently used in the mechanical equipment field for long-term delivery were satisfactory.

He also took issue with efforts in recent years to establish uniform pricing policies where differentials in the cost of distribution provided a substantially higher profit margin on sales to utilities than on sales to other classes of customers.

Answering requests by manufacturers for counter-proposals, Cole offered four principles for the establishment of pricing policies (see above). These are based on discussions with a sizable cross-section of public utility buyers.

First of three manufacturing representatives to answer buyer complaints and state his company's views on pricing was P. T. Lagrone, manager of electric utility sales for the Westinghouse Electric Corp. Pricing, he declared, involves two important principles. The first is that the manufacturer is entitled to some protection against rising costs. The second is that

MEMO

To: Utility Suppliers
From: Utility Buyers
Subject: Principles for price adjustments and prices

1. Flexible pricing should be limited to reasonably long-term delivery transactions. Transactions which do not involve undue risk of cost increase should be priced firm against increase.

2. Price adjustment should be a two-way street, with the buyer having a position in cost changes.

3. Price adjustment formulas should be realistically related to cost changes. Profit position should be established at the time of the base quotation and not altered through a formula which marks up price much more than cost increases.

Even considering that the seller may be entitled to the same ratio of profit on the cost increases there are factors other than costs which enter into the original computation of price. But price adjustment provisions, in which the buyer does not have competitive opportunity, are definitely presented to buyers as a means of protecting against unforeseeable cost increases.

4. Differentials justified because of substantially lower transportation, reduced costs of production because of heavier quantities of orders, and economies in costs of transacting business should be established and/or reestablished.

manufacturers are entitled to a reasonable profit. Profit is of interest to the utility industry as much as it is to the manufacturer because it enables the manufacturer to carry on research and development.

In a discussion of his company's profits it was pointed out that shifts in policy on escalation were necessary because experience had shown that earlier formulas did not provide adequate relief from rising costs.

Every Business Has Problems

The fact that the mechanical equipment manufacturers have worked out a type of escalation which was acceptable to utility buyers did not necessarily mean that the electrical manufacturers could offer a similar formula. Every business, Lagrone pointed out, has its problems and has to meet those problems in its own way.

H. G. Ebdon, vice president of Combustion Engineering, Inc, in discussing his company's views on pricing indicated that a good policy must result in a fair profit to the seller and a reasonable return on the capital investment of the buyer. After discussing a few of the factors which enter into his company's pricing policy, he added that its policy was set in the hope of showing a net operating profit of 5 to 6%. He also added that it had not been able to reach this figure having averaged only 4%.

Cyclic Utility Buying Attacked

Cyclic buying sprees of the utility industry, Ebdon stated, do not permit efficient programming of shop operations. Traditionally pessimistic forecasts have caused financial executives to hold back until the last minute. Then an industry-wide buying spree has followed. In 1950 the Korean affair brought this condition on; and in order to meet the demand, his company started a $15-million expansion program. In 1950 purchases were five times the 1949 volume; but as soon as the expansion had been completed, bookings tumbled. Now the race is on again with 1955 bookings more than double 1953 and 1954 combined. More than two thirds of the 1955 bookings were made in the last six months.

The high manufacturing costs resulting from such peak loading. Ebdon warned, must be taken into account and must be paid by the purchaser. The utilities are the only ones who can eliminate or reduce this cost.

In discussing Allis-Chalmers's price policies, J. S. Morgan, director of utility sales, told the utility buyers that generally speaking the company sells its products on the basis of price at the time of shipment. In addition, he said, Allis-Chalmers has ten alternates to this basic price protection plan to keep its products competitive.

Referring to Cole's comments on the many variations of price adjustment since World War II, Morgan observed that he believed the electrical manufacturers and their customers would have been much better off had they developed initially a formula price policy which would have held up in any contingency instead of the existing succession of policy changes.

Firm Prices Bother Everyone

A second Allis-Chalmers consideration in setting price policies is that the policy be consistent with the company's position in respect to dealing with its suppliers, Morgan explained. The company is constantly striving for favorable prices in the purchase of its raw materials so as to be able to maintain competitive prices for the finished equipment it sells. Unfortunately purchasing agents for electrical equipment manufacturers have the same problems that their counterparts in the utilities have. They have difficulty in getting firm prices on future deliveries of basic commodities, such as steel and copper.

Admitting that the escalation formula on large major items of electrical equipment is not perfect, Morgan said he was convinced after analysis of a large number of the company's contracts shipped in the last several years that utility buyers will find it about as satisfactory as most clauses today, including that used by the so-called mechanical product industry.

Some Products Firm-Priced

"We feel this is especially true, considering that the clause leaves to the buyer's option the economics of minimizing the effect of labor and material indices for the month of shipment by means of distributing payment over the life of the contract," Morgan continued.

Utility equipment which Allis-Chalmers sells on a firm price basis for competitive reasons and to avoid misunderstandings, listed by Morgan, includes all switchgear and circuit breakers; distribution transformers, 167 kva, single phase and smaller; motors, 5,000 hp and smaller; steam turbines, 44,000 kw and smaller; steam condensers, 25,000 sq ft and smaller; water conditioning equipment; small hydraulic turbine-driven generators; synchronous condensers; and control equipment.

70,000-Kva Transformer Uses Aluminum Windings

Forty-two miles of aluminum wire are now going into a 70,000-kva, 275/13.2-kv transformer. The unit, believed the world's largest aluminum-wound power transformer, is being made for Aluminum Co of Canada's Kitimat smelter in northern British Columbia.

The transformer will consume about 11,000 lb of aluminum wire. The h-v windings will be paper insulated, while the 1-v wire will have an extra-heavy Formal coating.

Alcan already is operating a number of aluminum-wound transformers ranging from 220 to 20,000 kva. However, in the case of the 70,000-kva unit, aluminum was selected for the winding material to aid study of the design and economics of aluminum in still larger power transformers. This study is expected to provide practical data for future development of this aluminum application.

The aluminum-wound transformer is being assembled by English Electric Co at St. Catherines, Ontario. The unit will aid Alcan's current $190-million expansion at Kitimat—a program which is scheduled to add 60,000 tons of aluminum this year to the smelter's present 91,500-ton annual capacity. A further expansion is slated to boost production to 331,500 tons a year by 1959.

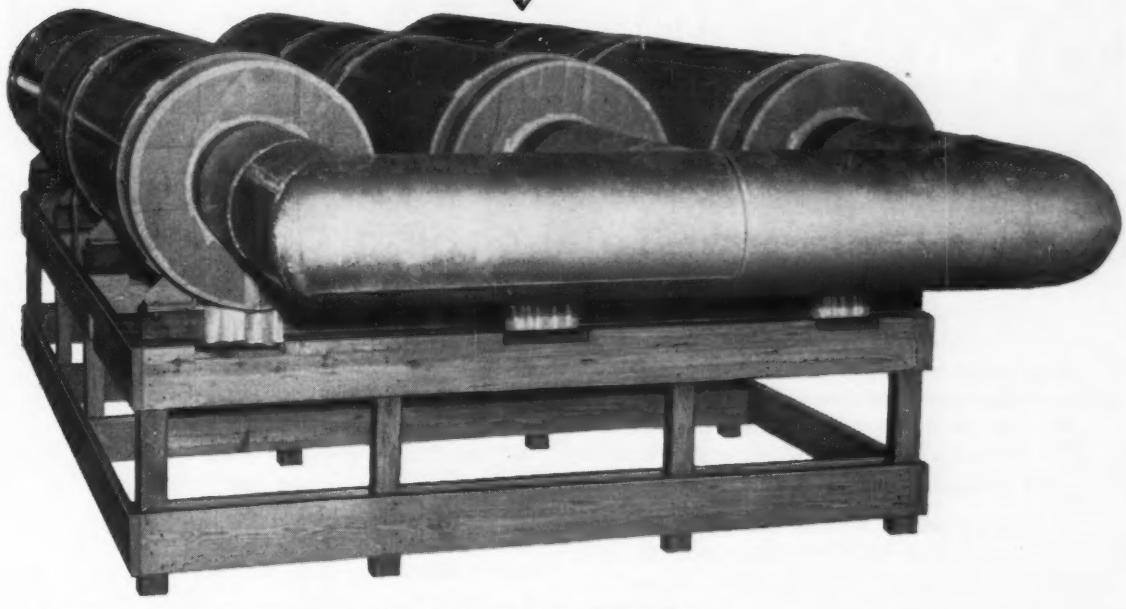
Aluminum Production

Primary aluminum production in the United States, according to the Aluminum Association, amounted to 140,748 tons in December, 1955, up from 133,688 tons the previous month, and an increase of more than 13,700 tons over December, 1954. Total production for the year 1955 was close to 1,565,800 tons, about 105,220 tons more than in 1954.

(*More M & M on page* 59)

First 10,000 amp **self-cooled** isolated phase bus ever built

I-T-E 10,000 amp self-cooled isolated phase bus in laboratory for thermal test.



. . . design eliminates auxiliary forced-air cooling equipment

Now you can get heavy current isolated phase bus of this rating and above without having to buy and maintain auxiliary equipment to cool it.

I-T-E design includes:

- All aluminum conductors
- Connectors—bolted or field welded
- Covers—telescoping type; split halves, bolted or field welded

For more complete information, write Switchgear Division, I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Phila. 30, Pa.

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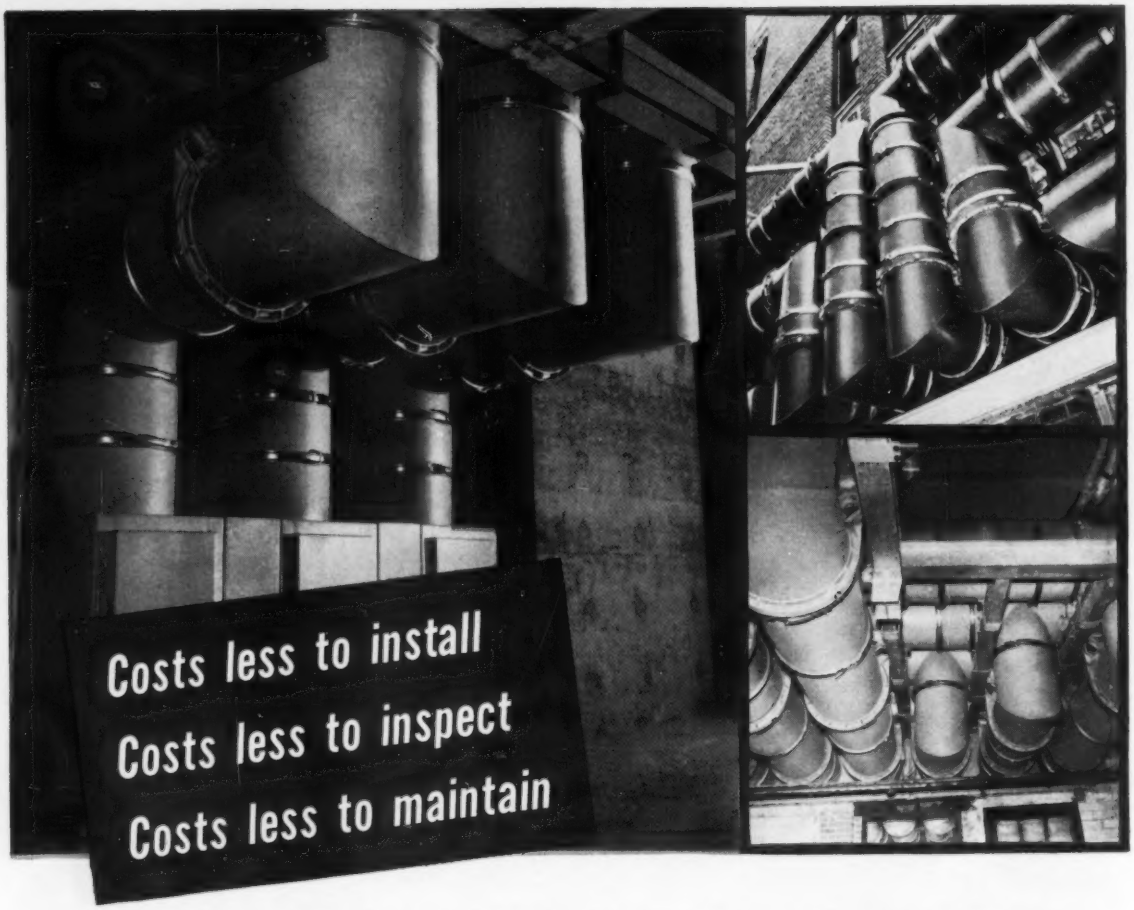


New Delta-Star Telescoping-Cover Bus

Compared to any other isolated phase bus, installing Delta-Star's new telescoping-cover bus is quicker, easier and more economical. That's because covers are an integral part of the enclosure—not separate units to install. No bolts needed—no covers to lift—no longitudinal gaskets required.

Quick access reduces bus inspection and maintenance time. Simply slide back the telescoping section to open—slide forward to close. Easily operated clamping rings lock and seal enclosure against moisture and dust.

At the State Line Station of the Commonwealth Edison system, the installation of a Delta-Star three-phase bus run demonstrates these cost-reducing advantages. This bus is used with a 207,000 kw cross compound turbine generator. It has a rating of 15.5 kv at 6,000 amperes for the generator of the high pressure turbine, and 5,000 amperes for the generator of the low pressure unit. Also, the bus from a transformer tertiary is rated 23 kv, 3,000 amperes.

For your next installation—be sure to check Delta-Star's telescoping-cover bus. Your Delta-Star representative is nearby.

DELTA-STAR ELECTRIC DIVISION

HKP

H. K. PORTER COMPANY, INC.

2437 Fulton Street • Chicago 12, Illinois
District Offices in Principal Cities

Aluminum Sheets Insulate Pipe at Outdoor Saguaro Station

Aluminum sheet insulation is used for virtually all piping at Arizona Public Service Co's outdoor Saguaro Station.

Shown inspecting this insulation at the recent dedication of the 200,000-kw plant is J. Alfred Rigby, Jr, (left) of Hunter Manufacturing Corp, Emilie, Pa. He pointed out features of a removal valve cover on a line coming from the condensate pump to a feedwater heater. Arizona Public Service observers (left to right) were: Walter T. Lucking, president; Edward A. Lodge, Saguaro superintendent; and George H. Groh, vice president.

Essentially all piping plus portions of the boiler duct work are insulated by aluminum sheets made by Hunter Manufacturing. The sheets consist of various numbers of parallel layers of aluminum built with an air space between each layer.

For an outdoor plant it was believed that aluminum sheet insulation would satisfactorily withstand skin temperatures up to 160F.

IBM Charts Expansion of West Coast Facilities

International Business Machines Corp recently announced plans for a multi-million dollar expansion of its West Coast operations.

The program features a 13-story office building and data-processing center in Los Angeles. This project is slated for completion by mid-1957.

Included in the expansion plans are: A six-story office building now nearing completion in San Francisco; 400,000 sq ft of manufacturing, engineering and education facilities to be completed at San Jose this fall; data processing centers to be installed soon in Portland and Seattle; and a recently completed two-story office building in Santa Monica.

U. S. Copper Production

U. S. production of primary copper was 96,962 tons in January, according to the Copper Institute, New York. This amount is almost 3,800 tons more production than in December, 1955, but about 2,550 tons less than the 1955 record in October. Production of refined copper was about 123,800 tons, a reduction of about 21,600 tons from December. Deliveries to fabricators amounted to 130,542 tons in January, about 8,300 tons less than the previous month. Refined copper stocks at the end of January were slightly over 50,000 tons, which is about 11,500 tons less than at the end of December.

M&M BRIEFS

Reliance Electric & Engineering Co is preparing final plans for a million dollar headquarters office building on its 67-acre property in Cleveland, Ohio. The new three-story building will have about 60,000 sq ft of floor area.

Brushmaster Saw Co reported that 24 Brushkings were purchased by a firm in Helsinki, Finland, for use in the timbering industry. The Brushking is a portable, gasoline-powered, brush-cutting machine made by the Keene, N.H., firm.

Allis-Chalmers Manufacturing Co was host recently to the first cavitation seminar of the American Society of Mechanical Engineers. The session at West Allis, Wis., dealt with operating characteristics of magnetostriction equipment, laboratory demonstrations, parameter variations, and comparisons with other methods of determining cavitation resistance. Representatives of industry, colleges and research attended.

Baldwin - Lima - Hamilton Corp announced recently that its new plant at Waltham, Mass., is scheduled to be ready for operation this fall. It will house the B-L-H Electronics and Instrumentation Division.

Thomas A. Edison, Inc, has developed an electronic device that is reported to add instant dictating service to any telephone. The Dial Televoice System utilizes inter-office dial phones to provide voice-actuated dictating service.

General Electric Co developments:

- Transistors are used in a new protective alarm relay for electric power systems. GE's transistor-controlled alarm unit of the negative-phase-sequence overcurrent relay is reported to be 3½ times more sensitive than previous designs.
- GE actively entered the industrial computer field through a recent broadening of computer activities from specialized engineering and military lines. Computer operations are now integrated into a computer section at Electronics Park, Syracuse, N. Y.
- The first completely new design in appliance motors in 25 years is GE's claim for a new fractional horsepower motor for home laundry and electric sink appliances. The unit is reported to be 24% lighter, more compact, and ventilated by five times more air through the windings than the former design.

BUSINESS OUTLOOK

Electrical World
FEBRUARY 27, 1956

For the moment, the economy has lost its forward momentum. It's running level on a high plateau. But this stability masks conflicting developments. Consumer durables and housing have slipped quite a way from 1955 peaks. Over-all business activity is sustained by the continuing boom in plant and equipment expenditures. Fears of immediate inflation are fading, and the Federal Reserve is moving slowly towards a gradual easing of the credit pinch.

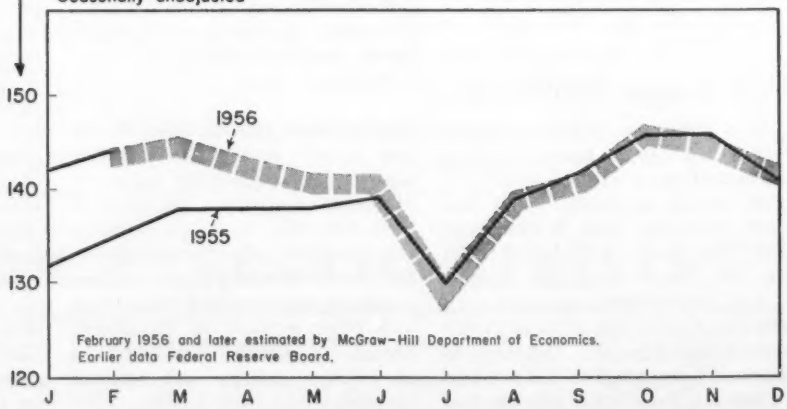
The drop in production of consumer durables is now substantial. **Latest figures show production of autos down nearly 13% from 1955 highs. TV's and radios were down 27%.**

The continuing decline in housing starts is discouraging in itself. And it also implies a less booming market for household durables. **January housing starts were 15% below a year ago, and were at an adjusted annual rate of 1,183,000.** This is the lowest rate since mid-1954. It's also the fifth consecutive month of decline in housing starts.

Government construction has not yet shown the hoped-for expansion. In fact, the January figure was 3% below last year's. Only booming commercial and industrial construction is preventing the industry from showing some slack. **Commercial construction was 32%, and industrial construction 23%, over the January 1955 levels.**

The Federal Reserve is now worrying less about inflation. It seems to have accepted the majority Washington view that recession is probably the greater danger in the next months. **If the President's announcement doesn't pick things up automatically they'll probably move cautiously to ease credit. Preferred method would be open-market buying of government securities.** This would pump more reserves into the banking system. And it would relieve the banks of the necessity of borrowing so heavily from the Federal Reserve, thus giving them the confidence to expand their own loans to business.

The Outlook for Industrial Production



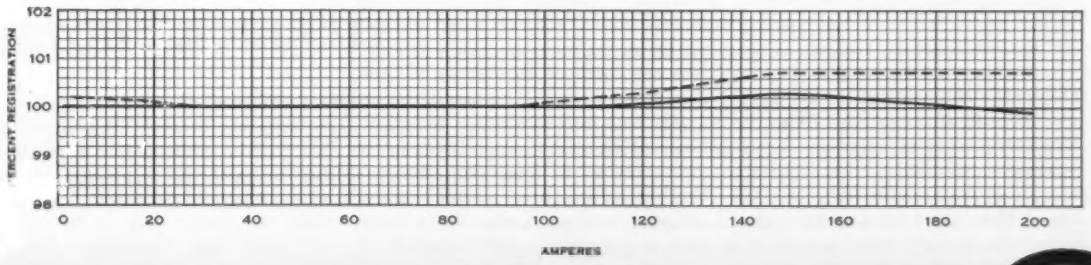
...match your 200 ampere service entrance equipment with Sangamo J2 200 ampere meters

With bigger and bigger loads to handle every day, it makes good sense to match full service entrance capacity with watthour meter capacity.

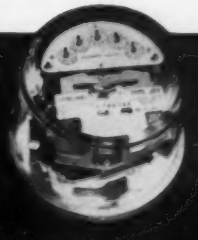
Sangamo J2 50-ampere nameplate rated watthour meters have straight-line accuracy up to 200 amperes.

Torque characteristics of the 50-ampere J2 are high ... 74.0 mmg. at nameplate rating. Average starting watts are low—only 18 watts. Just twice the starting watts of the J2 15-ampere meter.

The straight line accuracy of the J2 50-ampere single-phase will meter your "full use" customers' loads even if their demand goes to 48 KW. Take a look at the chart at the bottom of this page.



JM56-2



SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Candid Answers on Engineering Ethics

What is acceptable conduct for engineers in their daily work. Some 20 AIEE members at recent session came up with revealing answers to tough questions

Suppose you bought a railroad ticket, paid cash for it, and used it. A month later the railroad writes that you were undercharged and you owe a balance of $7. Should you pay this if convinced that it would rectify a previous mistake?

Yes. Pay the $7. That was the opinion of 19 of the 20 engineers taking part in a recent opinion test conducted as a part of the engineering ethics session at the Winter General Meeting of the American Institute of Electrical Engineers.

On other questions put to this group, selected at random from those attending the session, there was less unanimity. Their response was registered by means of an "opinion meter." Participants held individual controls which permitted them to register "yes", "no", or varying degrees of opinion. They could adjust these controls without disclosing individual opinions to observers.

Engineer's Role in Purchasing

Here are some of the questions put to this group and the responses:

Question: Is it permissible for engineers to rig specifications or to use other means to insure purchase of a favored product?

Answer: The "opinion meter" registered a 65% "yes." This was interpreted to mean that the group believed that such means are justified in 65% of the cases involving this question.

Q: Is it ethical to ask for bids from firms which have no chance of winning the contract?

A: The group registered 20% "yes."

On a series of broader questions involving engineering ethics and the role of professional societies, the participants in the panel registered these responses:

Q: Can an employed engineer fully discharge his professional responsibilities to the public and to other members of his profession?

A: This is possible about 80% of the time.

Q: Do you feel that membership in a union violates professional ethics?

A: The "opinion meter" read 60% "Yes."

Q: May a professional society intervene with an employer on matters of salary and working conditions affecting its members?

A: Participants registered a 65% permissible on this one.

Should Professional Society Intervene?

Q: Should AIEE or some similar organization of engineers create a committee to establish product engineering standards and push legislation backing up such standards?

A: "Opinion meter" registered 70% "yes."

Q: Should AIEE take direct responsibility for product engineering standards by supporting legislation at local, state, and federal levels which would give such standards a legal status?

A: Only 25% "yes" on this question.

Q: Should engineering organizations intervene with a manufacturer in cases where a member employed by the firm disagrees with the design of a product and where public safety is involved?

A: "Opinion meter" registered 60% "yes."

In evaluating these responses, it is well to consider that they were "off the cuff." Participants often made vocal qualifications after an opinion was registered, and they represent, at best, the opinions of only 0.4% of the AIEE members attending the Winter General Meeting.

TECHNICAL NOTES

Transient stability limits set by system disturbances prevent long transmission lines (say over 50 mi) from being purposely loaded to optimum values determined by cost factors.

Use of 50 to 110 v for portable tools, except where insulation of the operator from grounds is assured, is proposed for safety in Britain where 240 v is the standard supply.

Eye fatigue from voltage flicker caused by cyclic load variations on slow-speed synchronous motors driving compressors is commonly given as reason for building in flywheel effect. But an important byproduct is reduction of machine losses and metal fatigue from torsional vibration.

Declining dc load brings problems as knotty as its growth. Voltage drop and fault isolation become troublesome as supply stations are cut back to pare supply cost. And expenditures are difficult to justify for tightening up the dc system or for converting it and its customers' equipment to ac.

Much of our engineering progress is due to technical meetings and technical and industry journals.

Automatic dead transfer of auxiliary motors to alternate power source must be timed to permit residual motor voltage to decay yet re-establish power before drive slowdown becomes critical.

PUC Disallows Tax Amortization

- Pennsylvania commission orders Manufacturers L&H to use actual taxes
- Ruling is substantially the same as earlier order of the Citizens Water Co

The Pennsylvania Public Utility Commission, in the rate proceedings of the Manufacturers Light & Heat Co, ruled on Jan. 3 that only actual taxes resulting from the provisions of Section 167 of the Internal Revenue Code of 1954 should be used for rate making purposes.

This is the second order (the first being that of the Citizens Water Co of Washington, Pa., on 12/12/55) on which the PUC had ruled adversely using substantially the same language incorporated in the earlier order.

Declining Balance Method

The PUC noted that "Respondent has elected to take 'declining balance' depreciation applied to its composite plant life of 50 years used for tax purposes. Under this method, the straight-line rate of 2% in this instance becomes 4% applied to the depreciated cost base each year. Each $100 of new plant produces $4 of tax depreciation the first year, $3.84 the second year, $1.99 the 18th year, $1.38 the 27th year and lesser amounts each year thereafter, until the property is retired.

"Obviously, a 4% rate applied to a declining depreciated balance each year would never depreciate the entire cost of the property. The tax law, therefore, provides that the taxpayer may elect, at any time, to revert to the straight-line method to depreciate the then depreciated balance over the remaining estimated life of the property."

The order continued that "The tax effect of accelerated tax depreciation is negligible in our test year ended Oct. 31, 1954, but the tax effect will increase in future years somewhat in proportion to the amount of new property constructed after Dec. 31, 1953. Respondent contends that this actual reduction of $17,528 in income taxes should not be used in determining allowable income tax for rate purposes, thereby normalizing or leveling the effect of tax depreciation on allowable income taxes over the life of its new property," order said.

The PUC noted the difference between Accelerated Amortization of Emergency Facilities and the Accelerated Tax Depreciation Provisions under Section 167 of the Internal Revenue Code of 1954, when it said: "It is our opinion that accelerated tax depreciation of property having a 50-year tax life (or shorter life) is not the same in principle or in practical effect as the five-year amortization of emergency facilities permitted by tax law on plant costs certified by Office of Defense Mobilization to be property necessary to the nation's defense in a limited period of national emergency (Section 168 of 1954 Code).

"Amortization of emergency facilities is applicable only to a specifically identified plant unit and results in a tax saving for a definite five-year period, regardless of expected life, followed by offsetting higher subsequent tax payments. In contrast, accelerated tax depreciation is applicable to any or all types of property installed after Dec. 31, 1953, is calculated on the tax life of the property, and results in tax savings for an indefinite long period of time which may be perpetuity."

Accounting Method Cited

The PUC order continued to the effect that **"This Commission has authorized specific utility companies to normalize the tax effect of amortization of emergency facilities for accounting purposes, but we have not dealt with the matter in a rate order, which would also involve the proper rate case treatment of the accumulated offsetting normalization credits, whether they be designated Reserve or Restricted Surplus.** (Emphasis supplied.)

"No rate order by any other state commission has been reported dealing with accelerated tax depreciation, although several states (15 or more) have authorized normalization of income taxes for accounting purposes, with several of those states stating specifically that such accounting treatment was not effective for any other purpose, such as a rate case or approval of security issues."

Oklahoma PSC Rate Ruling

In connection with this latter statement it is of interest to note that on June 29, 1955 the Oklahoma Public Service Commission, on petition of the Oklahoma Natural Gas Co, ruled specifically that, with respect to rate making "The earnings of the company for rate determination purposes (rate base and rate making) shall be computed on the basis of normal depreciation and any tax savings effected by the application of accelerated depreciation or amortization of emergency facilities shall not be included in such rate determination computations. Any such savings may be treated as income on the books of account of the company or placed in reserve, or may be partly treated as income and partly placed in reserve in such amounts and proportions and at such times as may be determined by the management of the company to be good business practice."

In dealing with the effect of normalization of taxes as proposed by the company, the commission noted that "Respondent and other proponents of normalization of the tax effect of accelerated tax depreciation for rate purposes usually rely principally on the argument that utility rates based on actual taxes paid would discriminate against future customers in favor of present customers and also that accelerated tax depreciation merely results in a present-day 'deferral' of taxes, which certainly will be offset in future years when accelerated tax depreciation will be less than straight-line depreciation. It is also said that 'Congressional intent' was to allow the lower tax, in effect, as a temporary government loan, at zero interest, to be paid back through higher taxes in future.

"Opponents of normalization of the

tax effect of accelerated depreciation for rate purposes, contend that utility rates must be based upon actual income tax liability; that the tax savings is a permanent saving if plant construction in future years equals or exceeds present construction levels; and that Congressional intent creates no government loan because no liability exists."

As to its conclusions, the PUC remarked that the cost of administering the program the company proposed may be greater than the so-called "savings" effected under the accelerated tax depreciation.

Significantly the PUC noted "Had Congress 'decelerated' tax depreciation to raise more immediate revenue or for some other purpose, it is extremely doubtful that utilities would advocate that the current income tax allowance for rate purposes should be less than taxes actually paid."

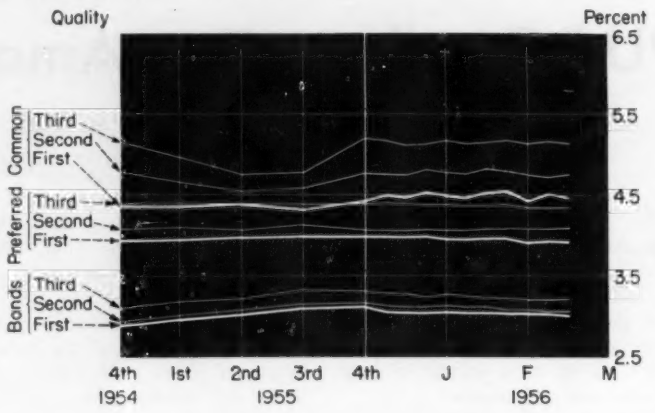
The commission concluded that "Considering this issue in the light of the foregoing comments and conclusions, we hold that accelerated tax depreciation does in fact permit utilities to reduce income taxes and reduce their actual cost of service over an indefinite but extended period of years.

"We hold also that accelerated tax depreciation no more justified normalizing allowable taxes than do some past tax depreciation practices of many utilities, or than do other provisions of the income tax law which have always permitted radical differences between tax deductibles of any utility and established utility and industrial accounting practices. We, therefore, reject respondent's claim and will allow income taxes which reflect the tax effect of accelerated tax depreciation."

REGULATION BRIEFS

Opposition has arisen in Mississippi legislature to a bill which would change the basis of fixing public utility rates from fair return on original investment to fair return on "reproduction cost new" or "fair value" rate base . . . A bill has been introduced in Georgia legislature proposing the formation of a nonprofit Southeast Natural Gas Authority to construct a pipeline from a point in Oconee County to Brunswick.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Feb. 16.....	3.02	3.07	3.20	3.93	4.10	4.38	4.49	4.74	5.13
Feb. 9.....	3.04	3.08	3.20	3.95	4.09	4.38	4.51	4.72	5.17

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Baltimore Gas & Electric.....	12	Dec.*	$14,075,000	$12,141,000	$2.11(a)	$1.95(a)
Pennsylvania Power & Light...	12	Dec.*	22,137,527	21,040,199	3.10	2.93
Texas Electric Service.....	12	Dec.*	10,910,131	10,341,053	....	....

Notes—* Subject to year-end audit; (a) Based on average number of shares outstanding.

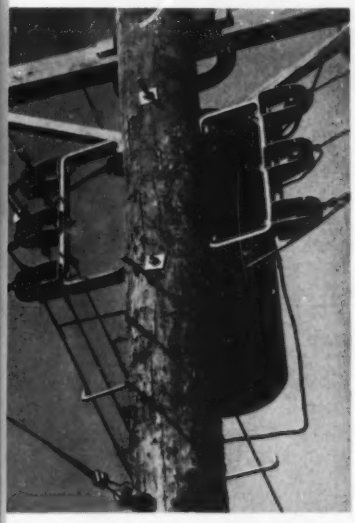
Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
SCHEDULE FOR FEBRUARY—MARCH			
BONDS			BID DATE
Kansas Gas & Electric—1st mtg due 1986.....	$7,000	.....	Feb. 27
Texas Electric Service—1st mtg due 1986.....	10,000	.....	Feb. 28
Southwestern Public Service—1st mtg due 1981.....	10,000	.....	Feb. 29*
Mississippi Power—1st mtg due 1986.....	4,000	.....	Mar. 1
Houston Lighting & Power—1st mtg due 1986.....	30,000	.....	Mar. 7
Alabama Power—1st mtg due 1986.....	14,000	.....	Mar. 15
Narragansett Electric—1st mtg due 1986.....	10,000	.....	Mar. 20
Pacific Gas & Electric—1st mtg due 1986.....	25,000	.....	Mar. 20
Georgia Power—1st mtg due 1986.....	12,000	.....	Mar. 29
PREFERRED STOCK			
Northern States Power—100,000 sh $100 par cum.....	$10,000	.....	Feb. 29
Southwestern Public Service—120,000 sh $25 par.....	3,000	.....	Feb. 29*
Mississippi Power—40,000 sh $100 par.....	4,000	.....	Mar. 1
Louisiana Power & Light—70,000 sh $100 par.....	7,000	.....	Mar. 20
COMMON STOCK			
Southern Indiana Gas & Electric—83,030 sh (to be offered commonholders on 1-for-11 basis, record Feb. 21 to expire Mar. 8).....	.....	.....	.....
Kansas Gas & Electric—200,000 sh.....	.....	.....	Feb. 27
Northern States Power—670,920 sh (to be offered commonholders on 1-for-20 basis, record about Mar. 1 to expire Mar. 20).....	.....	.....	.....
Oklahoma Gas & Electric—298,479 sh (to be offered commonholders on 1-for-10 basis, record about Mar. 8 to expire Mar. 27).....	.....	.....	.....

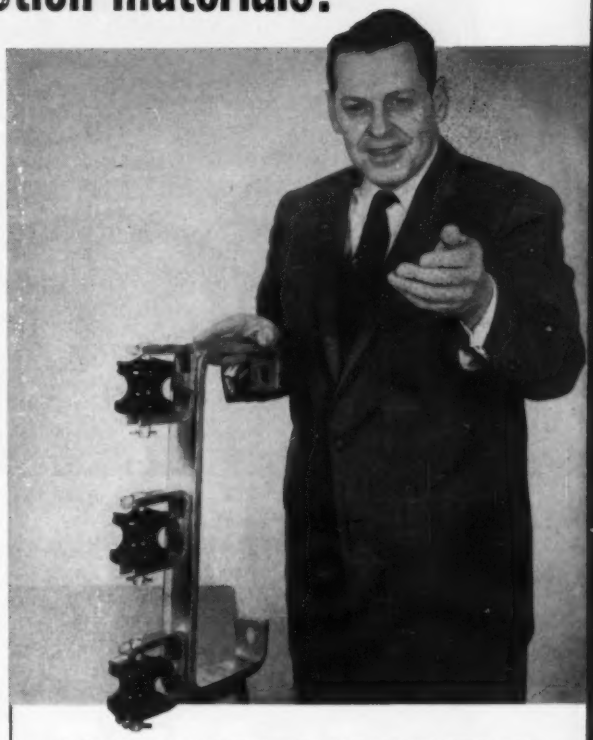
Note—*Dillion, Read & Co, underwriters

"We bought a company to give you more complete service on line construction materials!"

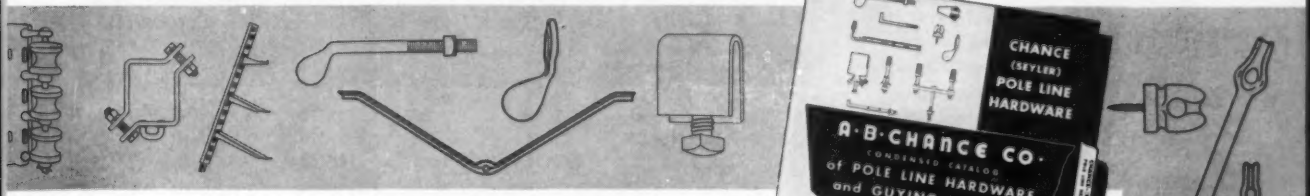
"The Seyler Manufacturing Company of Pittsburgh is now the A. B. Chance Company. One of the big reasons we bought Seyler was to offer our customers more complete service. Wholesale Distributors who carry Chance anchors and guying equipment can now supply you with Chance pole line hardware. This means you can quickly fill all your line construction needs at one source. It also means that Chance engineering facilities will be used for the development of new pole line hardware items such as this—



"Secondary Extension Bracket" ... the newest addition to Chance's wide range of pole line hardware. In the typical Union Electric installation shown at left, you can see there's plenty of climbing space on the pole ... a feature which meets the National Safety Code. Notice, too, the adequate clearance between secondary conductors and the outside diameter of the transformer tank."



JACK CURTRIGHT, Sales Manager, Electrical Wholesale Products, introduces the Chance secondary extension bracket. You'll find it is more economical than a standard secondary rack and separate extension brackets. Suggestions for the design of this new unit came from the Union Electric Company of Missouri.



CHANCE (SEYLER) POLE LINE HARDWARE
A·B·CHANCE CO·
CONDENSED CATALOG
of POLE LINE HARDWARE and GUYING MATERIAL
CHANCE ANCHORS and GUYING MATERIAL

Send for your FREE COPY of this condensed Chance Catalog!

Here's a find-it-quick reference for everything you need in pole line hardware and guying material. Actually, it's a combination catalog and file folder. You'll like the way the information is arranged to help you find what you want quickly and easily.

CP56-7

Please send me the Chance *condensed* Pole Line Hardware and Guying Material Catalog.

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CITY & STATE_____

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MO., San Francisco, Cal., Pittsburgh, Pa.

STATISTICS

Capabilities and Peak Loads—December 1955

(Thousands of Kw)

Region	Capabilities: Oct. Estimate	Capabilities: Actual at Peak	Peak Loads: Oct. Estimate	Peak Loads: Actual Peak	Dec. 1954	% Changes (Peak Load): Dec. Act. / Oct. Est.	% Changes (Peak Load): Dec. '55 / Dec. '54	% Gross Margins: Oct. Est.	% Gross Margins: At Peak
I	24,865	24,872	21,532	22,339	20,302	+3.7	10.0	15.5	11.3
II	22,081	21,710	18,648	19,095	15,557	+2.4	22.7	18.4	13.7
III	21,343	20,588	18,525	18,343	15,414	—1.0	19.0	15.2	12.2
IV	14,422	14,755	11,856	12,081	10,936	+1.9	10.5	21.6	22.1
V	11,668	11,251	7,529	7,491	6,736	—0.5	11.2	55.0	50.2
VI	2,571	2,541	1,952	1,962	1,592	+0.5	23.2	31.7	29.5
VII	8,962	9,243	8,339	8,231	7,267	—1.3	13.3	7.5	12.3
VIII	10,422	10,835	8,744	8,648	7,897	—1.1	9.5	19.2	25.3
Total U. S.	116,334	115,795	97,125	98,190	85,701	+1.1	14.6	19.8	17.9

Source: Edison Electric Institute

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Dec.	114.37	113.55	102.59	11.5
Peak—Class I Systems (million kw)	Dec.	98.2	96.4	85.7	14.6
Estimated Dec. '56 Peak (million kw)	Nov.	104.55	104.34	102.71	1.8
Production—billion kwhr	Dec.	50.72	47.76	43.45	16.7
Hydro		9.31	9.21	9.05	2.9
Fuel		41.41	38.54	34.38	20.4
Sales—billion kwhr	Nov.	43.07	43.16	36.29	18.3
Residential		10.71	10.33	9.72	10.2
Commercial		6.61	6.87	6.08	8.7
Industrial		23.37	23.45	18.26	28.0
Other		2.38	2.51	2.23	6.7
Fuel Consumption	Dec.				
Coal—million tons		14.77	13.29	11.91	24.0
Oil—million barrels		8.54	7.10	7.69	11.1
Gas—billion cu ft		70.00	82.26	74.85	—6.5
Net Income Class A & B Co's—$ million	Nov.	104.29	95.67	95.12	9.6
Residential Customers—millions	12 mos.	44.30	44.21	43.04	2.9
Revenue per kwhr	ended	2.65¢	2.65¢	2.70¢	—1.9
Avg kwhr per customer	Nov. 30	2,728	2,715	2,529	7.9
Avg annual bill		$72.29	$71.95	$68.28	5.9

Business Statistics . . .

Indexes: 1947-49 = 100					
FRB Industrial Production	Jan.	143	141	132	8.3
ENR Construction Cost	Jan.	141.8	141.1	135.1	5.0
BLS Cost-of-living	Dec.	114.7	115.0	114.3	0.3
NEMA Sales	Dec.				
Insulation materials		160	155	138	15.9
Electric appliances		101	88	74	36.5
Wholesale prices	Dec.				
Motors and generators		127.2	127.0	121.8	4.4
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		145.9	145.9	135.3	7.8
GNP—annual rate—$ billion	3rd Qtr.	392.0	384.8	358.8	9.3

Transformer fabrication must be done carefully, with skill . . . to assure proper performance and to prevent damage that might later result in breakdowns.

That's why transformer fabrication requires men with ability . . . and plant capacity. Moloney has both, and for you it means transformers that are dependable . . . because they're properly designed and skillfully fabricated to provide better overall operating performance.

ME55-55

Specify Moloney . . . Get Dependability at its Best . . . All Along the Line

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Power Transformers • Distribution Transformers • Load Tap Changing Transformers
Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary
Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers
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SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Fast Delivery from

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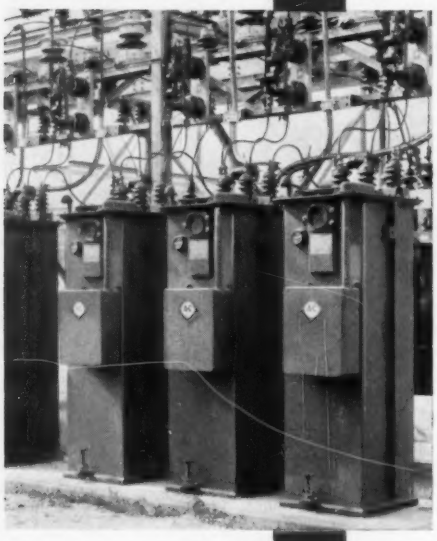
keeps regulators operating at their best



Here's what happened when a northern utility called an Allis-Chalmers office for regulator parts. Thanks to Allis-Chalmers nationwide stocking program, the parts were on hand. Next morning these parts were at the utility location and the regulator back on the line.

That's everyday service from Allis-Chalmers. A-C people understand your need for continuous operation and they cooperate in helping you get it. Field stocks and field service are designed to help you get the most profit from your regulator operation.

Next time you consider a voltage regulator purchase, consider that you're buying regulation, not just a regulator. You'll go Allis-Chalmers all the way — because Allis-Chalmers field regulator service goes all the way to meet your needs.

Find out for yourself. Ask about A-C regulator service. Call an Allis-Chalmers office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4842

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